



Three Exotic Plant Diseases Threatening Florida Training Guide



SART Training Media



Three Exotic Plant Diseases Threatening Florida

Training Guide

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Published February 2007

SART Training Media are available for download from the Florida SART Web site
<www.flsart.org>.

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About Florida SART

- SART is a multi-agency coordination group.
- SART is made up of over 25 partner agencies (state, federal and non-governmental organizations).
- SART provides preparedness and response resources for Emergency Support Function 17 [(ESF 17) Animal and Agricultural Issues].
- SART statutory authority
 - State Emergency Management Act (Section 252.3569, Florida Statutes)

SART Mission

Empower Floridians through training and resource coordination to enhance all-hazard disaster planning and response for animal and agricultural issues.

SART Goals

- Support the county, regional and state emergency management efforts and incident management teams.
- Identify county resources available for animal and/or agricultural issues.
- Promote the cooperation and exchange of information of interested state, county and civic agencies.

Specific Learning Objectives

At the end of this training module, participants will be able to:

- To provide team members with a basic understanding of three exotic plant diseases now threatening Florida agriculture – citrus greening, soybean rust and sudden oak death – and to recognize the consequences of their spread.

Resources

The following are sources of additional information about the subjects mentioned in this introduction.

US Department of Agriculture, Animal and Plant Health Inspection Service (www.aphis.usda.gov/) The APHIS public citrus greening web site (www.citrusgreening.net). The USDA soybean rust web sites are (www.usda.gov/soybeanrust/ or www.sbrusa.net/) and the APHIS web site is (www.aphis.usda.gov/ppq/ep/soybean_rust/). Look at (www.na.fs.fed.us/spfo/pubs/pest_al/sodeast/sodeast.htm) for the USDA sudden oak death pest alert.

Florida Department of Agriculture and Consumer Services

<https://www.freshfromflorida.com//>

Florida State Agricultural Response Team

www.flsart.org

Integrated Pest Management, IFAS Extension, University of Florida

<http://ipm.ifas.ufl.edu/>

Southern Plant Diagnostic Network

<https://www.npdn.org/spdn>

Soybean rust

www.aphis.usda.gov/ppq/ep/soybean_rust/

California Oak Mortality Task Force

<http://nature.berkeley.edu/comtf/>

The Nature Conservancy, Global Invasive Species Initiative

<http://tncweeds.ucdavis.edu/products/gallery/phyra1.html>



Three Exotic Plant Diseases Threatening Florida

Appendix A - Training Slides



SART Training Media



Three Exotic Plant Diseases Threatening Florida



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Acknowledgements

- **Photographs and diagrams**

- Department of Bacteriology, University of Wisconsin-Madison
- Florida Dept. of Agriculture & Consumer Services
- Institute of Food & Agricultural Sciences, University of Florida
- Steve Koenning
- Tim Schubert, PhD
- Rick Sapp, PhD
- US Department of Agriculture and USDA Forest Service



Learning Objectives

- To provide team members with a basic understanding of three exotic plant diseases now threatening Florida agriculture – citrus greening, soybean rust and sudden oak death – and to recognize the consequences of their spread.



The Value of Agriculture in Florida

- 1.25 million residents earn livings in agriculture producing billions in market value crops
- Florida's top agricultural sectors:
 - Cane for sugar
 - Citrus
 - Dairy
 - Forest products
 - Greenhouse/nursery products
 - Tomatoes



Importance of citrus in Florida



- Florida produces 80 percent of all US citrus
- Florida ranks 2nd in the world, following Brazil, in citrus production
- In total, citrus accounts for about 90,000 jobs in Florida and \$900 million in taxes at all government levels



Diseases threatening Florida citrus

- citrus greening
- citrus variegated chlorosis
- citrus chlorotic dwarf virus
- sweet orange scab
- black spot of citrus
- citrus leprosis virus
- lime witches' broom
- citrus sudden death



Citrus Greening



- Known in China for 100 years where it was called "yellow dragon disease"
- Has probably been in Brazil for 6-7 years where it is widespread possibly due to propagation sloppiness
- Now documented in Florida



What does citrus greening do?

- The first sign of infection may be leaf mottling or the yellowing of entire tree sectors. This sectoring will not usually be uniform and it can affect one branch without affecting others.
- Progressive yellowing of the entire canopy follows sectoring. Citrus trees may fruit for 20 – 25 years. After infection, they frequently succumb within one to three years: fruit ripens unevenly (remains “green”) and may become misshapen; seed growth is often aborted.



Citrus Greening – Example 1



Citrus Greening – Example 2



Citrus Greening - Example 3



Citrus Greening - Example 4



Photo: Stephen M. Garnsey



Citrus Greening Up Close



Citrus Greening – The Fruit #1

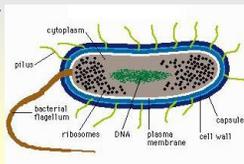


Citrus Greening – The Fruit #2



How is citrus greening spread?

- A spreading disease requires a "**pathogen**," a means of transmission or "**vector**" and a **host**.
- The pathogen for citrus greening is *Candidatus Liberobacter*, a bacterium similar to the generalized form below.



A “vector” carries the bacterium

- The bacterium is carried to its citrus host by a vector, in this case, a psyllid.
- This psyllid first appeared in Florida in 1998.
- Today, they are found throughout the state (adult pictured, right.)



Florida’s Citrus Host

- No citrus is immune to citrus greening.
- It affects the entire plant: leaves, stems, roots, growing points, inflorescence, fruit and seeds.



Who will help control citrus greening?



Identifying citrus greening

- Yellow sectoring in trees
- Mottled, yellowing leaves
- Small, lopsided fruit
- Aborted, misshapen seed
- Notches in leaves
- Psyllids in the air



Results of feeding by citrus psyllids.



Biological controls

- Two Asian parasites are planned for release in Florida:
 - *Tamarixia radiata* can reduce populations of citrus psyllid.
 - In the photo below, *Diaphorencyrtus aligarhensis* inserts an egg into a citrus psyllid nymph.



Chemical controls



- Because the bacterial pathogen *Candidatus Liberobacter* has been found on psyllids in Florida, chemical controls will almost certainly be a part of the psyllid control equation.



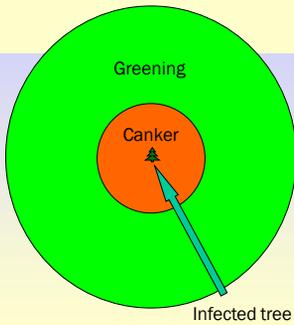
Cultural controls

- The only effective means of controlling an outbreak of citrus greening is the complete removal of infected trees and plants as soon as possible.



Red: An exposure radius of 1,900 feet is used for citrus canker.

Green: The estimated exposure radius for citrus greening is 0.9 mile (how far Asian citrus psyllids can fly.) This involves 6.8 times the area for canker.



Orange jasmine

- Orange jasmine or *Murraya paniculata* is a preferred host of the Asian citrus psyllid. This insect has moved through Florida via sales of orange jasmine in large retail stores.



Related - CVC Citrus Variegated Chlorosis

- Like greening, CVC first appears as leaf mottling or yellow sectors in a tree. Symptoms resemble zinc or manganese deficiencies, which are common. Fruit are small and hard. A close up view of the symptomatic leaf with *intraveinal chlorosis* may show gummy-looking raised bumps in yellow areas on leaf undersides. Overall impact is the same as citrus greening.



Part II: About Soybeans



- A native Asian plant, Soybeans are an important international crop because 40% of a bean is oil, 20% is protein and 35% carbohydrates
- The US produces 55% of the world crop
- Less than 1% of Florida's agricultural crop is soybeans



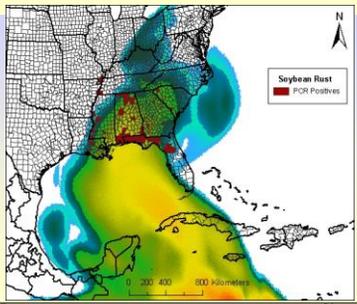
What is soybean rust?

- Soybean rust is a fungus, either *Phakopsora pachyrhizi* or *P. meibomiaae*. Of the two, only *P. pachyrhizi* is of real concern. Soybean rust is transmitted by wind-blown spores to host legumes.
- At least 31 legume species in 17 different genera, plus many more experimentally, can be infected.
- Like soybeans, soybean rust is native of Asia.
- Hurricane Ivan blew spores from Venezuela to the US in 2004.
- Today, rust is confirmed in Florida, Georgia, Alabama, Mississippi, Louisiana, North and South Carolina and Texas, as well as Mexico.



The Spread of Soybean Rust

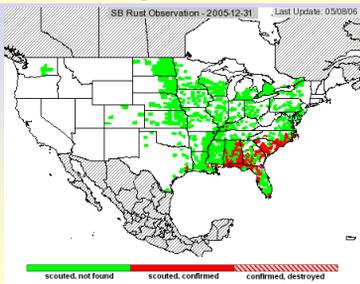
The initial 2004 prediction of spore distribution from Hurricane Ivan.



State Agricultural Response Team

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Recent USDA Identification of Soybean Rust

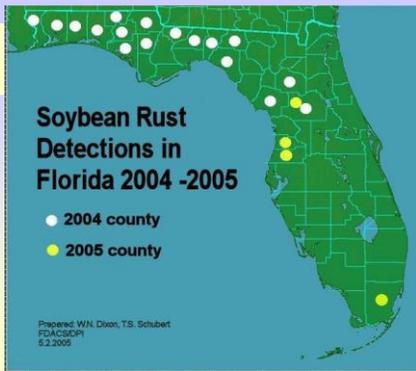


State Agricultural Response Team

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Soybean Rust Detections in Florida 2004 -2005

- 2004 county
- 2005 county



Prepared: W.N. Dixon, T.S. Schubert
FDACS/SP1
5/2/2005



State Agricultural Response Team

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Rust symptoms and impact



- Checking fields for soybean rust, pay attention to:
 - early planted fields with early maturing varieties,
 - low-lying or protected fields with prolonged dew periods and
 - fields with early canopy closure.



Rust infection

- Look for small, necrotic raised pustules on the underside of leaves, eventually spreading to the entire plant.



Soybean rust treatment



The natural cure



Biologists hope that host resistance will minimize rust impact.



Surprise host and vector! Can you identify this plant?



Soybean rust in kudzu



Part III: Sudden oak death



SOD – Greatest Potential Impact

- Sudden oak death has greatest potential for harming Florida’s booming nursery and greenhouse industry, an even larger sector of private industry jobs than citrus!



What is sudden oak death?

- The pathogen: a fungus-like organism called *Phytophthora ramorum* probably arrived in the US on rhododendron imported from Asia.
- This infection has two “syndromes:”
 - Bark canker, established on the West Coast, is lethal to some trees, but has not been found in Florida.
 - Leaf-and-twig blight is not normally lethal, but is detrimental to plant health and was found in Florida in the Spring of 2004 and in 2006.



SOD – Bark Canker Syndrome



- The SOD bark canker kills trees. Trimming away the bark can reveal the severity of the infection. It is not found in Florida.



SOD – Leaf-&Twig Blight Syndrome



- *Camellia japonica* was the host when SOD leaf-and-twig blight entered Florida from a California nursery in 2003.



What does SOD look like?



- SOD foliar stage of the leaf-and-twig blight syndrome on camellias. It is the only known host for *P. ramorum* in Florida ... so far!



Ultimate leaf-and-twig syndrome.



Leaf and twig blight syndrome on *viburnum* have killed this plant.



SOD on other hosts.



Citrus aurantium



Alnus californica



Vaccinium vitis-idaea



Taxus brevifolia



Additional sources of information and support

- US Department of Agriculture, Animal and Plant Health Inspection Service www.aphis.usda.gov/. APHIS' on citrus greening www.citrusgreening.net. USDA's soybean rust web sites are www.usda.gov/soybeanrust/ or www.sbrusa.net/. APHIS web site is www.aphis.usda.gov/ppq/ep/soybean_rust/. The USDA on sudden oak death www.na.fs.fed.us/spfo/pubs/pest_al/sodeast/sodeast.htm.
- Florida Department of Agriculture and Consumer Services www.doacs.state.fl.us/
- Integrated Pest Management, IFAS Extension, University of Florida <http://ipm.ufl.edu/>
- Southern Plant Diagnostic Network <http://spdn.ifas.ufl.edu/Citrus%20Greening.htm>
- Soybean rust www.aphis.usda.gov/ppq/ep/soybean_rust/
- California Oak Mortality Task Force <http://nature.berkeley.edu/comtf/>
- The Nature Conservancy, Global Invasive Species Initiative <http://tncweeds.ucdavis.edu/products/gallery/phyra1.html>



Florida and The World



Working Together To Protect Florida's Agriculture & Way of Life



The End

Now, Test Your Knowledge and Awareness (1 of 4)

1. Name two of the top sectors (in terms of dollars) of Florida's agricultural economy.
2. Name the plant disease that is considered the greatest potential threat to Florida citrus.
3. (True/False) Called *huanglongbing* in China where it originated in the 19th century, citrus greening disease is carried by the Mediterranean fruit fly.
4. (True/False) In an orange grove, one result of citrus greening disease is green oranges.



Test continued (2 of 4)

- 5. (True/False) Citrus greening and the related plant disease CVC can not spread to humans who consume infected fruit.
- 6. (Circle one) Soybean rust arrived in Florida in 2004 as a result of:
 - A terrorist cell
 - A hurricane
 - A homeowner planting exotic soybeans
 - The greenhouse effect



Test continued (3 of 4)

- 7. (Fill in the blank with the best answer) Soybean rust can rapidly destroy as much as _____ of a soybean crop.
 - 100% the first year
 - About half every year
 - 10-80% depending on conditions
- 8. (True/False) Sudden oak death is a terrible infestation that threatens to destroy all of Florida's forests.
- 9. (Fill in the blank) _____ What common flowering species has been most prominent in the spread of sudden oak death through America's network of plant nurseries?



Test continued (4 of 4)

- 10. (Fill in the blank) _____ is primarily responsible for preventing the introduction and spread of noxious plants and diseases in Florida.
- BONUS QUESTION – If you suspect a plant disease, whether an established and well-understood disease such as citrus canker or an emerging threat such as *citrus variegated chlorosis*, you should contact _____.



Test Answer Key

1. Any combination of the following: cane for sugar, citrus, dairy, forest products, greenhouse/nursery products or tomatoes
2. Citrus greening
3. False. Citrus greening is spread by an exotic psyllid.
4. True. It also causes plants to yellow and fruit to shrivel.
5. True. Citrus greening and CVC cannot be spread to humans.
6. A hurricane (Ivan in November 2004)
7. 10-80% depending on conditions
8. False.
9. Camellia
10. All Floridians have a responsibility.

Bonus: Contact your county agricultural extension office or the Dept. of Agriculture & Consumer Services Help Line: 1-888-397-1517.



GLOSSARY

- Host: A living plant or animal from which a parasite obtains nutrition.
- Pathogen: Any disease-producing agent, such as a virus, bacterium or fungus.
- SART: Florida State Agricultural Response Team. A multi-agency coordination group consisting of governmental and private entities dedicated to all-hazard disaster preparedness, planning, response and recovery for the animal and agricultural sectors in Florida.
- Vector: Something, often an insect, that carries and transmits a disease-causing organism.



Three Exotic Plant Diseases Threatening Florida

- That concludes our presentation on “Three Exotic Plant Diseases Threatening Florida.” Thank you for attending and for participating!