

Plant Biosecurity- Local and Global Perspectives



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First Detectors Protecting U.S. from Pests

What are the Issues?



Photo Credit: Stephen Ausmus, USDA-ARS, USDA-ARS Image Gallery,
<http://www.ars.usda.gov/is/graphics/photos/>, Image No. D001-1



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What are the Issues?



Photo Credit: Peggy Greg, USDA-ARS, USDA-ARS Image Gallery
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What are the Issues?



Photo Credit: Stephanie Stocks, University of Florida



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Photo Credit: Scott Bauer, USDA-ARS, USDA-ARS Image Gallery,
<http://www.ars.usda.gov/is/graphics/photos/>, Image No. K4250-8



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What are the Issues?



- 2007: First time in history that urban populations are larger than rural.
- World population estimated at greater than 9 billion by 2050.
- Global poverty alleviation is dependent upon agriculture.

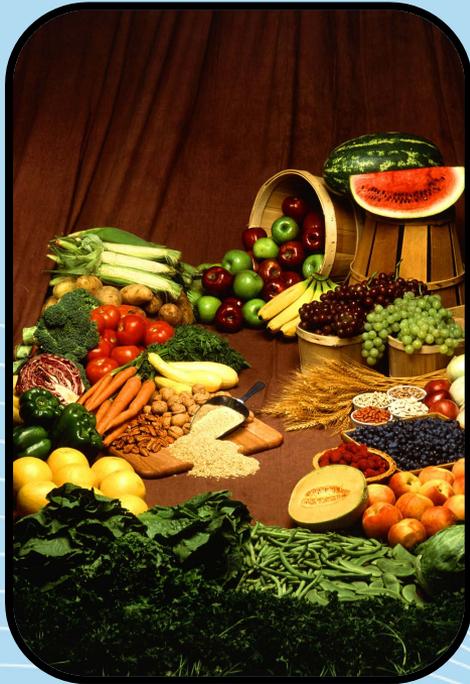
Photo Credit: Amanda Hodges, University of Florida
Urbanization-Lagos, Nigeria



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What are the Issues?



- Increased wealth results in a higher demand for diverse diets, including various meats, fruits, and vegetables.
- Grain production uses less water.



Photo Credits: left: USDA-ARS Image Gallery Imagery <http://www.ars.usda.gov/is/graphics/photos/>, Keith Weller, USDA-ARS, Image No. k8339-3; right: Scott Bauer, USDA-ARS, Image No. k9455-1



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Summary

- Agricultural Productivity
- Consumer Cost and Demand
- Urbanization
- Market Value of Agricultural Commodities
- Food Security and Safety
- Water Use
- Minimizing environmental impact



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Food Security News

The screenshot shows the FAO Media Centre website interface. At the top, there are language options: العربية, 中文, english, français, italiano, русский, and español. The main header is "Media Centre". On the left, there is a sidebar with the FAO logo and the text "Food and Agriculture Organization of the United Nations for a world without hunger". Below this is a search bar and navigation links for "Media Center" and "FAO". The main content area features a news article titled "Pakistan farmers need wheat seed fast" with a sub-headline "Flooded country risks losing a year's crop, further threatening nutrition of poor". The article includes a photograph of farmers carrying wheat sacks and a quote from Daniele Donati, Chief of FAO Emergency Operations. To the right of the article, there are sections for "Audio" (with a download link for an interview with Daniele Donati), "Related links" (including "Agriculture, food security & FAO's response in Pakistan" and "Pakistan UN One Response"), and "Contact" information for Hilary Clarke and Aly Khan. At the bottom right, there is a "Toolbox" with options for "Email this article", "Print", "Share", "122 retweet", "Facebook", and "RSS".

FAO Website: September 1, 2010

An interview with Daniele Donati is featured here -

<http://www.fao.org/news/story/en/item/45027/icode/>

A follow up to this story can be found here - <http://www.fao.org/news/story/en/item/54043/icode/>.



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Food Security Example – Rice



Photo Credit: David Nance, USDA-ARS, USDA ARS Image Gallery,
<http://www.ars.usda.gov/is/graphics/photos/>, Image No. K2958-7



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Is America's Food Supply Safe?



- Related to U.S. and international agricultural production issues.
- Economic and social impacts of a plant-production based bioterrorism attack would be devastating.

Photo Credit: Scott Bauer, USDA-ARS, USDA-ARS Image Gallery, <http://www.ars.usda.gov/is/graphics/photos/>, Image No. k8991-1



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What are the Issues?



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20th Century Agroterrorism

- Glanders
- Can be commonly seen today in Africa, Asia, the Middle East, Central and South America.
- Used by Germany, WWI and Japan, WWII



Photo Credit: Scott Bauer, USDA-ARS, USDA-ARS Image Gallery,
<http://www.ars.usda.gov/is/graphics/photos/>, Image No. k8855-1



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20th Century Agroterrorism

- Anthrax
- Somewhat common disease in tropical countries
- Occurs occasionally in the U.S.
- Used by Japan, WWII

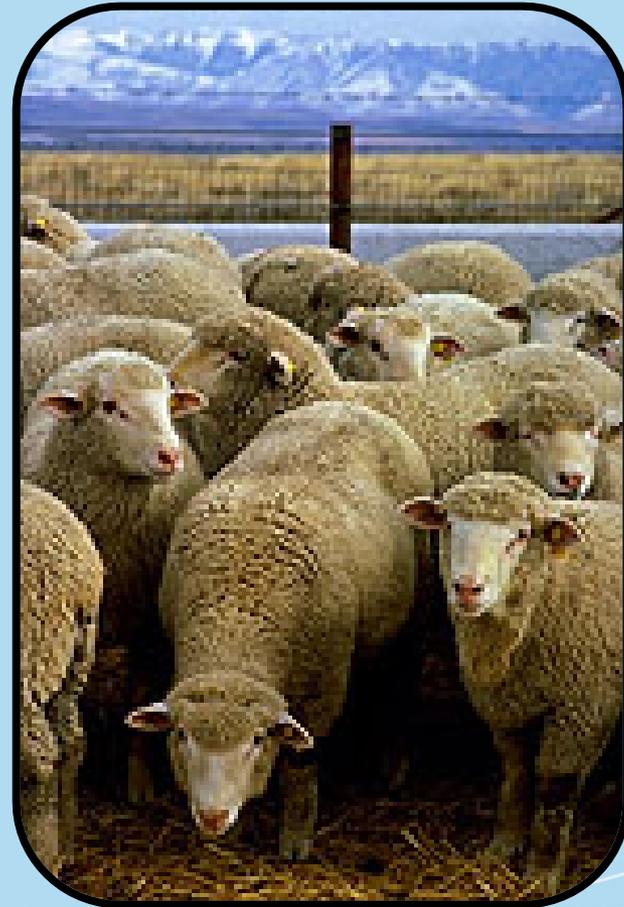


Photo Credit: Scott Bauer, USDA-ARS, USDA-ARS Image Gallery,
<http://www.ars.usda.gov/is/graphics/photos/>, Image No. K4166-5



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20th Century Agroterrorism

- Rinderpest
- Occurred in Europe, Africa, and Asia
- Used by Japan, WWII
- Global eradication declared on June 28, 2011



A video about GREP's efforts to eradicate rinderpest can be found at the FAO website here - <http://www.fao.org/ag/againfo/programmes/en/grep/home.html>

Photo Credit: Scott Bauer, USDA-ARS, USDA-ARS Image Gallery, <http://www.ars.usda.gov/is/graphics/photos/>, Image No. k4148-10



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20th Century Agroterrorism

- Colorado Potato Beetles
- Used by Germany, WWII



Photo Credit: David Cappaert, Michigan State University,
<http://www.bugwood.org/> Image No. 5178045



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20th Century Agroterrorism

- African bush milk
- Used by the Mau Mau, 1952



Photo Credit: Scott Bauer, USDA-ARS, USDA-ARS Image Gallery,
<http://www.ars.usda.gov/is/graphics/photos/>,
Image No. K7686-7



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20th Century Agroterrorism

- Mercury poisoning of Israeli oranges
- Used by the Arab Revolutionary Council, 1978



Photo Credit: USDA-ARS Image Gallery
<http://www.ars.usda.gov/is/graphics/photos/>,
Image No. K3644-12



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20th Century Agroterrorism

- Pesticide poisoning of grapes
- Used by Israeli individuals in Gosh Etzion, 1997
- ~17,000 metric tons of grapes destroyed

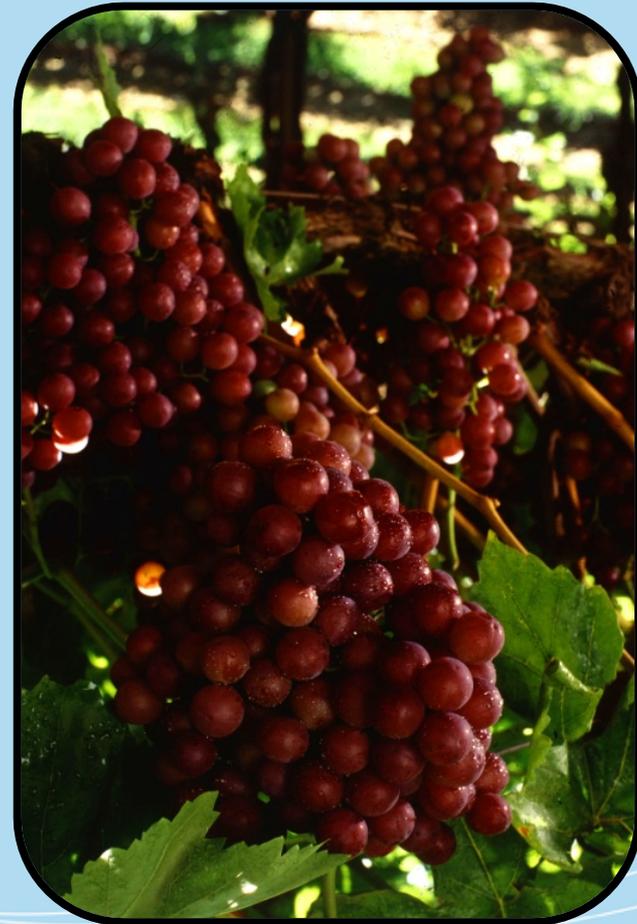


Photo Credit: Patrick Tregenza, USDA-ARS, USDA-ARS Image Gallery, <http://www.ars.usda.gov/is/graphics/photos/>, Image No. K5632-3



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20th Century Agricultural Bioweapons Programs

- Canada, 1940s-1960s
- France, 1939-1972
- Former Soviet Union, 1935-1992
- Germany, 1915-1917
- Iraq, 1980s-unknown
- Japan, 1937-1945
- South Africa, 1980s-1993
- United Kingdom, 1937-1960s
- United States, 1943-1969



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Select Agents and Toxin List

- Public Health Security and Bioterrorism Preparedness Response Act of 2002, HHS
 - CDC
- Agricultural Bioterrorism Protection Act of 2002, USDA
 - APHIS-VS
 - APHIS-PPQ
- Lists updated biannually



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USDA-APHIS-PPQ

Select Agent and Toxin List

- *Peronosclerospora philippinensis* (*Peronosclerospora sacchari*)
- *Sclerophthora rayssiae* var *zeae*
- *Phoma glycinicola* (formerly *Pyrenochaeta glycines*)
- *Ralstonia solanacearum* race 3, biovar 2
- *Rathayibacter toxicus*
- *Synchytrium endobioticum*
- *Xanthomonas oryzae*



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Philippine Downy Mildew (PDM)



- Tropical Africa and Asia
- Maize, Sugarcane, Sorghum, Oats, Grasses
- Chlorotic striping followed by downy growth on or under leaf surface
- Followed by abnormally erect leaves that appear dried out followed by malformed tassels, interrupted ear formation and sterile seeds

Photo credits: C. De Leon -

<http://www.ars.usda.gov/SP2UserFiles/Place/00000000/opmp/Corn%20Downy%20Mildew%2009-18-06.pdf>



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Brown stripe downy mildew

- Found in tropical Asia
- Mainly affects corn, but can be found in crabgrass
- Narrow chlorotic stripes (mostly yellow, but sometimes red to purple)
- Lesions with well defined margins that come together to form large, necrotic lesions. May have small seed size.



Photo credits: C. De Leon -

<http://www.ars.usda.gov/SP2UserFiles/Place/00000000/opmp/Corn%20Downy%20Mildews%2060918.pdf>



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Red Leaf Blotch (RLB)

- Central and Southern Africa
- Soybeans
- Lesions along the veins which spread to the lower leaf and then come together to form necrotic regions
- Can also form lesions on pods, stems, and petioles

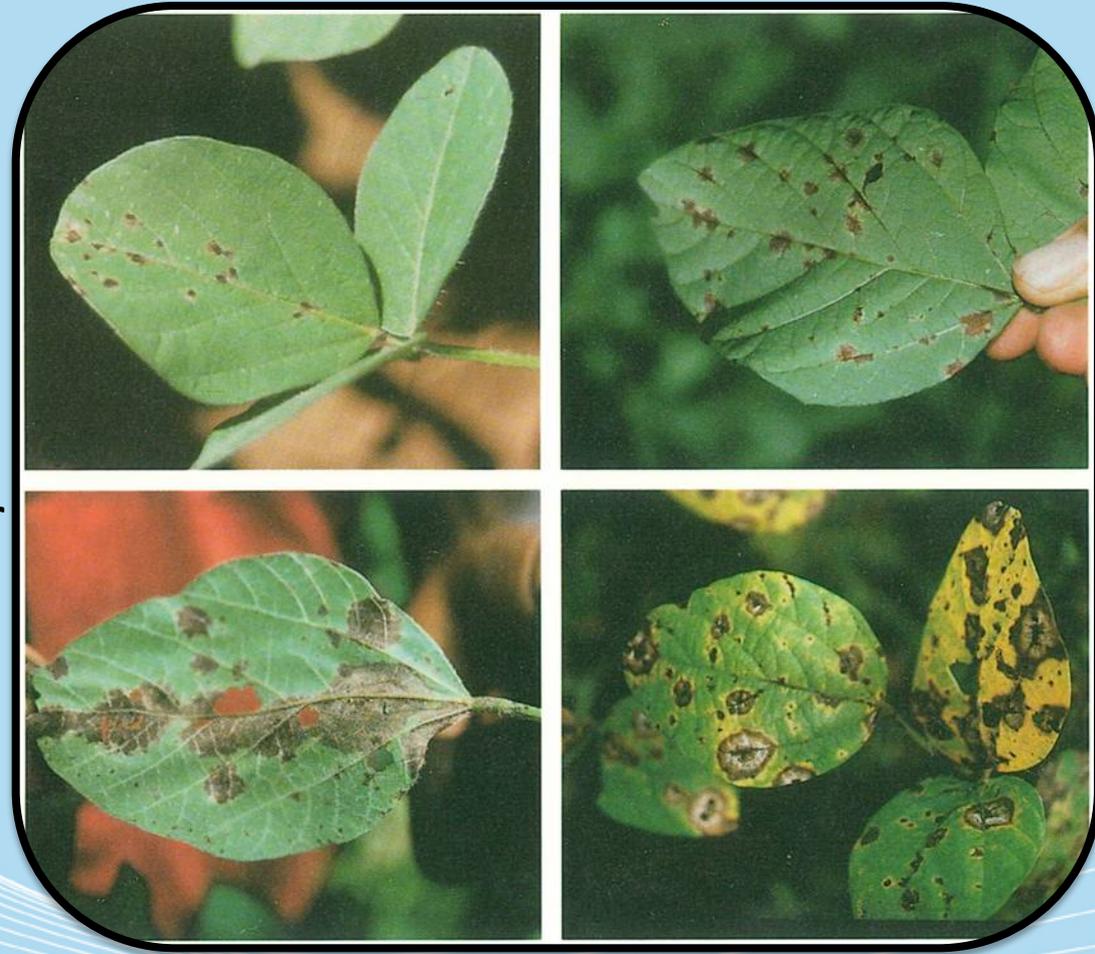


Photo credits:

<http://www.ars.usda.gov/SP2UserFiles/Place/00000000/opmp/Soybean%20RLB%20FINAL%20July%202009.pdf>



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Southern Wilt, Bacterial Wilt, and Brown rot



- Found around the world
- Mainly affects solanaceous plants
- Brown rot in potatoes - leaves wilt during the daytime, then recover during the night. They may develop a bronze cast and turn downwards.
- Plants become stunted and chlorotic with the stem having a streaked brown appearance.



Southern Wilt, Bacterial Wilt, and Brown rot



- Bacterial wilt in tomatoes – wilted leaves that do not drop, turning yellow and stunted, then brown and dry.
- May see vascular discoloration.

Photo credit: H. David Thurston, Cornell University, <http://www.tropag-fieldtrip.cornell.edu/docthurston/Thumbs%20-%20Brown%20Rot/Brown%20Rot.html>



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Southern Wilt, Bacterial Wilt, and Brown rot



- Southern wilt in geraniums - leaves wilt during the daytime, then recover during the night. Lower leaves wilt first, then become chlorotic.
- You may see – v-shaped chlorotic or necrotic areas on leaves, brown discoloration of the vascular system, rarely leaf spots.

National Plant Diagnostic Network

e-learning Module:

Ralstonia solanacearum

race 3, biovar 2

NPDN
National Plant Diagnostic Network

Bacterial Ooze

Another diagnostic sign for potato brown rot in the field is bacterial ooze that can be observed from:

- Intact tubers at eyes or where the stolon attaches to tuber, that is often revealed by soil aggregation to tubers.
- Vascular ring of cut potato tubers, particularly when the cut tuber is squeezed.



R. solanacearum bacterial ooze from vascular tissues (vascular ring) in cut potato tuber



Soil adherence at eyes of potato tuber due to *R. solanacearum* bacterial ooze

[Exit](#) [Previous](#) [Next](#)

NPDN
National Plant Diagnostic Network

Symptoms On Potato and Tomato

First visible symptoms of potato brown rot and tomato bacterial wilt are:

- Wilting of the youngest leaves.

These symptoms often are visible during the hottest part of the day.

They may appear on just one side of a leaflet or on a single branch and at any stage of plant growth.



First symptom of potato brown rot in the field showing wilt of youngest leaves

At this stage, plants may appear to recover at night when temperatures are cooler.

High temperatures (85 to 95°F) favor symptom expression.



First symptom of tomato bacterial wilt in the field showing wilt of youngest leaves

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Gumming Disease



- Found in Australia, New Zealand, and South Africa
- Mainly affects rye and other grasses
- Nematode vectored with galls being produced (symptom). The bacteria will reproduce in the galls and in the seeds of the plant. Gumming is a sign of the disease.
- Produces corynetoxins which can kill livestock.



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Photo credit:

<http://www.ars.usda.gov/SP2UserFiles/Place/00000000/opmp/RathayibacterPoisoningFeb2010.pdf>

Potato Wart Disease



- Found around the world
- Mainly affects potatoes
- Above ground symptoms are rarely seen
- Attacks tubers, not roots, with warty, cauliflower-like protuberances originating at the eyes which spreads and eventually replaces the tuber tissue which will then rot and disintegrate.

Photo credits:

Central Science Laboratory, Harpenden Archive, British Crown, www.bugwood.org, #0454023 and Michael Hampson, <http://www.ars.usda.gov/SP2UserFiles/Place/00000000/opmp/PotatoWart70109.pdf>



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Bacterial Blight



- Found around the world, except Europe
- Mainly rice, wild rice varieties, and some sedges
- pale-green to grey-green water soaked streaks near the leaf tip and along the margins with lesions turning yellow-white and having wavy edges as they get larger.
- On the inflorescences, you can see light brown to grey lesions that result in infertility and low quality of the grains



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Bacterial Leaf Streak

- Found in tropical Asia
- Mainly rice and wild rice varieties
- narrow, dark-greenish water soaked interveinal streaks of various lengths (which is initially restricted to the leaf blades).
- lesions enlarge, turn yellowish-orange to brown), and have small amber colored droplets of bacterial ooze present on them. Lesion margins are more linear.



Photo credit:

Top - International Rice Research Institute, Los Banos Archive, International Rice Research Institute, Los Banos, www.bugwood.org, # 1949007 and

Bottom - Donald Groth, Louisiana State University AgCenter, www.bugwood.org, #5390469



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Former Select Agents and Toxins

- Citrus Greening, *Candidatus Liberibacter asiaticus*
- Detected in U.S. in August 2005
- De-Listed as a Select Agent October 2008



Photo credit:
Florida Department of Agriculture and Consumer Services, Division of Plant Industry –
<http://www.freshfromflorida.com/pi/chrp/greening/cgphotos.html>



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Ricin

- Castor beans are poisonous, however, ricin is derived from the waste material left over from processing castor beans to make castor oil.
- India produced almost 375,000 tons of castor oil in 2009.





Ricin Symptoms

- Inhalation: respiratory distress, fever, cough, nausea, and tightness in the chest. Low blood pressure, respiratory failure, and death may result.
- Ingestion: Vomiting, diarrhea that is bloody, severe dehydration, low blood pressure, hallucinations, seizures, blood in the urine, liver, spleen, and kidney failure, and even death.
- Skin and eye exposure: contact usually results redness and pain, but it is unlikely that ricin can be absorbed through normal skin.
- There is no antidote to ricin poisoning.





Plant Biosecurity

- Do only USDA-APHIS-PPQ select agents threaten U.S. Plant Biosecurity?



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Questions?

- For more information, check out www.protectingusnow.org
- You can also contact:
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[Center for Invasive Species and Ecosystem Health \(i.e. the Bugwood Network\)](#)



[Local and Regional Integrated Pest Management programs \(IPM\)](#)



[USDA-APHIS](#)



[U.S. Department of Homeland Security \(DHS\)](#)



[Extension Disaster Education Network \(EDEN\)](#)



[U.S. Forest Service](#)



[Cooperative Agriculture Pest Survey Program \(CAPS\)](#)



[National Plant Board \(NPB\) and State Departments of Agriculture](#)



[National Plant Diagnostic Network \(NPDN\)](#)



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