

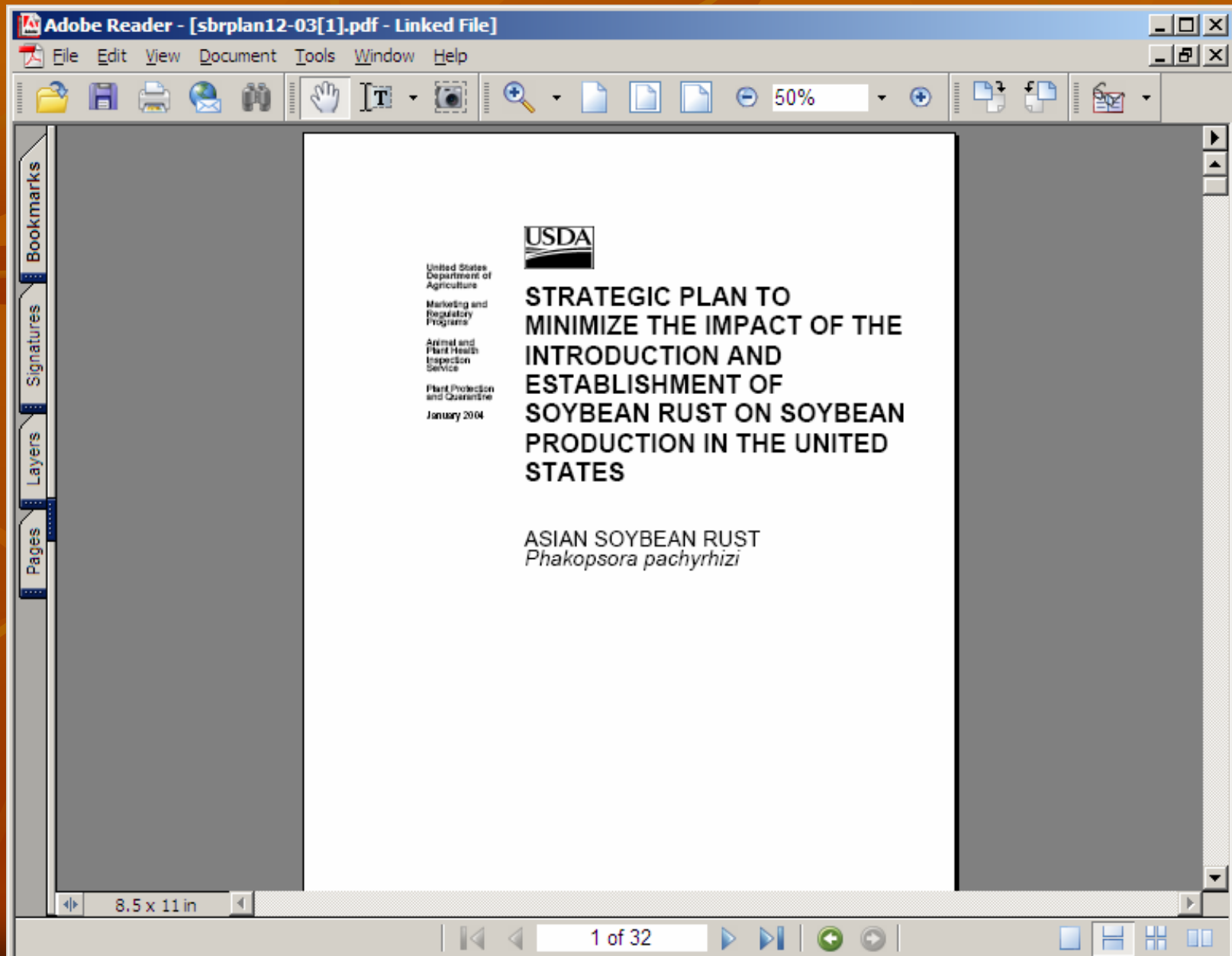
Soybean Rust



Matt Royer, USDA-APHIS

November 15, 2005

USDA SBR Strategic Plan



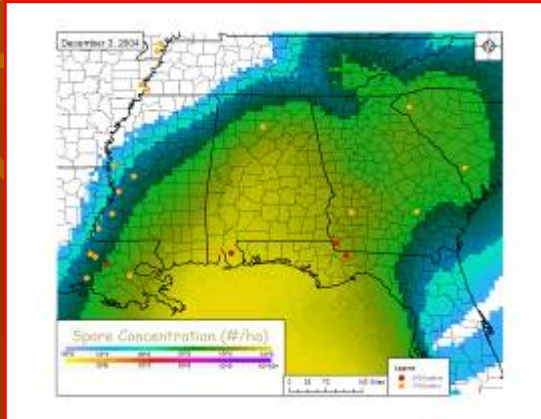
Strategic Plan Elements:

Protection

Detection

Response

Recovery



Protection

**Status of Scientific Evidence on
Risks Associated with the
Introduction into the Continental United States of
Phakopsora pachyrhizi
With Imported Soybean Grain, Seed and Meal**



Detection

Address <http://npdn.ppath.cornell.edu/default.htm>

Go Links Customize Links Windows

NATIONAL PLANT DIAGNOSTIC NETWORK



NPDN

[Home](#)

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[Mission Statement](#)

[Marketing Material](#)

Information

[Regional Network](#)

[Members](#)

[National Contacts](#)

[Protection Act of 2002](#)

[Agricultural Permits](#)

[EDEN- Extension
Disaster Education
Network](#)

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**Areas of
Concentration
*Restricted***

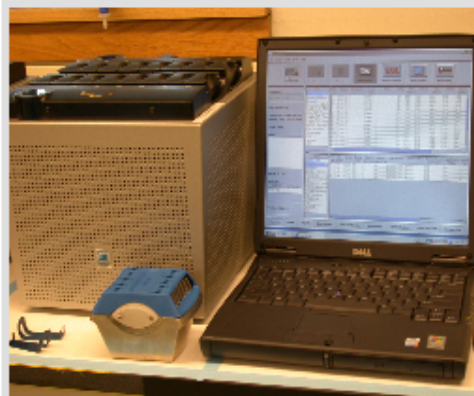
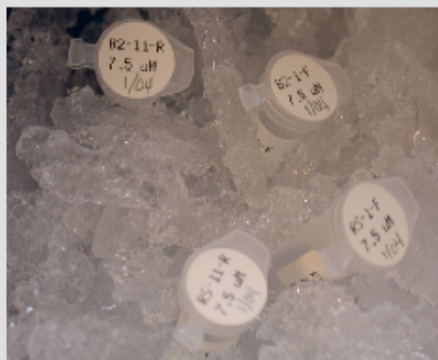
[Coordination &
Governance](#)

[Training & Education](#)

Real Time PCR Training

Members of the National Plant Diagnostic Network (NPDN) met recently in Beltsville, Maryland to participate in advanced diagnostic training. During the first week of February, eleven members of the NPDN participated in real time PCR, molecular analysis training to detect two select agent pathogens that cause the diseases known as Soybean Rust and Southern Wilt of Geranium or Brown Rot of potato.

The training was hosted by Dr. Laurene Levy and her colleagues of the USDA, PPQ, CPHST, National Plant Germplasm and Biotechnology Laboratory.



Real time PCR protocols were demonstrated and performed by representatives from the five regions that comprise the national network. Participants included Karen L. Snover-Clift of Cornell University representing the Northeast Plant Diagnostic Network ([NEPDN](#)); Carrie Harmon of the University of Florida, Mary Ann Hansen of Virginia Tech, and Clarissa Balbalian of

PCR Training:

Carrie Harmon, Univ of FL
Cheryl Blomquist, CDFA
Clarissa Balbalian, MS State Univ.
Janette Jacobs, MI State Univ.
Joy Pierzynski, KS State Univ.
Karen L. Snover-Clift, Cornell Univ.
Karen Rane, Purdue Univ.
Kim Maxson, TX Tech
Mary Ann Hansen, VA Tech
Melodie Putnam, OR State Univ.
Nancy Pataky, Univ. of IL

More ...

Detection



National Pest Alert

Soybean Rust

Phakopsora pachyrhizi and *P. meibomia*

Distribution and Transmission

Two fungal species, *Phakopsora pachyrhizi* and *P. meibomia*, cause soybean rust, an aerial disease first detected in the United States in 2004. *P. pachyrhizi* was first reported in the United States in 1993 and was confirmed to be the same species as the one reported in Japan in 1993 and was confirmed to be the same species as the one reported in Japan in 1993. *P. pachyrhizi* was first reported in the United States in 2004. *P. meibomia* was first reported in the United States in 2004. *P. pachyrhizi* was first reported in the United States in 2004. *P. meibomia* was first reported in the United States in 2004.



Host Range

P. pachyrhizi is capable of infecting more than 90 species of legumes. However, the number of species infected in nature is unknown. The host range of *P. pachyrhizi* in the United States and Canada is limited to soybean and soybean root pathogens. The host range of this fungal pathogen is the result of rapid spread across the United States.



Identification of Soybean Rust

Molecular analysis provides rapid and accurate identification to differentiate between *P. pachyrhizi* and *P. meibomia*. Early symptoms of soybean rust resemble bacterial pustule (*Xanthomonas axonopodis* pv. *glycines*) and brown spot (*Sporisorium oblongum*). Soybean rust can be distinguished from bacterial pustule and brown spot by examining the lesions under a hand lens (20x) or dissecting microscope. The mature soybean rust lesion contains cone-shaped pustules with a pore on the top with spores inside or on top of the cone.



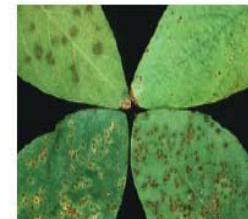
APHIS purchased 25,000 copies- distributed to extension specialists and integrated pest managers at 78 locations to give to soybean growers and crop consultants.

Outreach

Symptoms and Disease Development

Soybean rust symptoms are similar for *P. pachyrhizi* and *P. meibomia* species. Symptoms begin on the lower leaves of the plant as small lesions that increase in size and change from gray to tan or reddish brown on the undersides of the leaves. Lesions are most common on leaves but may occur on petioles, stems, and pods. Soybean rust produces two types of lesions, tan and reddish brown. Tan lesions, when mature, consist of small pustules (uredinia) surrounded by slightly discolored necrotic area with masses of tan spores (uredia) on the lower leaf surface. Reddish brown lesions have a larger reddish brown necrotic area, with a limited number of pustules (uredinia) and few viable spores (urediniospores) on the lower leaf surface. Once pod set begins on soybean, infection can spread rapidly to the middle and upper leaves of the plant.

Environmental conditions impact the incidence and severity of soybean rust. Prolonged leaf wetness combined with temperatures between 59 and 86°F and humidity of 75-80% is required for spore germination and infection. Under these conditions, pustules form within 5-10 days and spores are produced within 10-21 days. High levels of infection in soybean fields result in a distinct yellowing and browning of fields and commodity premiums decrease in plants.



Various stages of soybean rust on soybean leaves.

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Sample Collection Procedures

Collect samples immediately if you suspect soybean rust is present on soybean or other hosts. Place each plant sample in a self-locking plastic bag and maintain under cool conditions (refrigeration). Place samples in sealed paper bags if cool conditions are not available. Once refrigeration is available, each sealed paper bag should be placed inside a self-locking plastic bag before cooling. Leaves should be kept flat by placing them between paper towels or pieces of paper. Record the following information for each sample collected: date, host plant, collector's name, phone number, collection location within field and location of field, including state, county, township, and nearest road intersection. Global positioning system location information is requested if available. Mark sample containers with a permanent marker and print all information.

Sample Submission

Submit samples to your state's university diagnostic laboratory or Department of Agriculture diagnostic laboratory for identification contact university extension personnel for the address of the diagnostic laboratory. Each state is developing an invasive species response program as part of the USDA National Plant Diagnostic Network. If samples are identified as soybean rust by state diagnosticians, species verification by molecular analysis will be required.

Management Recommendations

All commercial varieties currently available are highly susceptible. Current research includes screening germplasm for resistance and evaluating fungicide efficacy. Early detection is required for the most effective management of soybean rust. Monitoring soybean fields and adjacent areas is recommended throughout the growing season. Fungicide applications may reduce yield loss, depending on the plant developmental stage, time when soybean rust is detected, and fungicide application method. For efficacy information on fungicides labeled for use on soybean, consult university extension personnel in your state.

For more information on soybean rust, visit our Web site at <http://www.ncpna.org/soybeanrust>

This publication was produced and distributed in cooperation with USDA-CREES Integrated Pest Management Centers, National Plant Diagnostic Network, APHIS, and ARS. For more information regarding the development of this document, contact Susan T. Ruciffe at sruciffe@arizona.edu or by phone at (217) 333-9656.

Photos courtesy of Glen Hartman (USDA-ARS) and David Kieck (University of Illinois, College of Agricultural, Consumer and Environmental Sciences); scanning electron microscopy of spores courtesy of Muriel Bunde (USDA-ARS); and soybean rust illustration courtesy of Joel Floyd (USDA-APHIS-IPQ). Editor: Kala L. Todd (Department of Entomology, Iowa State University). Graphic designer: Gretchen Winkler (Studio 2D, Clumpajays, IL).



Detection

IDENTIFYING SOYBEAN RUST

Upper leaf symptoms

Pustules (open) under 20x magnification

Early symptoms

For confirmation and diagnosis of soybean rust contact your state plant diagnostic lab. These can be found listed at www.aphis.usda.gov/diagnostic/soybean_rust_diagnostics.asp

When scouting for soybean rust, focus on:

- Early planted fields with early maturing varieties
- Low lying or protected fields with prolonged dew periods
- Fields with early canopy closure

For soybean rust detection on the plant:

- Examine lower leaves of the plant
- Use a 10 to 20X hand lens to detect pustules (open) on underside of leaves

Ontario

LAND GRANT

NEPPA **OHIO STATE** **USDA**

LOOKING FOR SIMILAR DISEASES

BACTERIAL BLIGHT

- Affects mid-to-upper leaves.
- Angular lesions, reddish-brown to black centers. Initial angular water soaked lesions with yellow halo.

Difference from Soybean Rust: Water soaking; angular lesions; lesions on leaf underside are not raised.

BACTERIAL PUSTULE

- Affects in mid-to-upper leaves.
- Lesions — small spots to large irregular shapes without water soaking.
- Lesions associate with main veins; pustules form in lesion corners on leaf underside. (100X)

Difference from Soybean Rust: Pustules not always with each lesion; pustules do not have spores in openings; openings are cracks instead of circular pores.

DOWNY MILDEW

- Affects upper leaves.
- Spots on surface enlarge into yellow lesions.
- Older lesions turn brown with yellow-green margins; size varies with age of leaf affected.
- Fuzzy fungal gray tufts on leaf underside (20X).

Difference from Soybean Rust: Lesions larger than rust lesions; no raised pustules on underside; fuzzy fungal growth on underside.

CONIOPIGIA BLIGHT AND PHYTOEYEA LEAF SPOT

- Blight affects upper leaves exposed to sun after seed set; Phytoeyea affects lower leaves first.
- Blight starts as light purple areas on upper leaf surface with itch expands to cover surface; leaves leathery and dark reddish purple on upper surface only.
- Phytoeyea lesions start as dark water soaked spots; can have light centers; circular to angular brown spots with dark red brown margins.

Difference from Soybean Rust: Blight — overall leaf area is affected on upper surface only. Phytoeyea — discrete lesions larger than rust with defined lesion margins; no pustules evident on underside.

BROWN SPOT

- Affects lower leaves first.
- Irregular shaped dark brown lesions on both leaf surfaces; size — small spots to large areas; adjacent lesions can form irregular shaped blotches.
- Infected leaves quickly yellow and drop.

Difference from Soybean Rust: No raised areas on leaf underside; angular lesions; if dark lesions, lack of under is key symptom. First symptoms can look like rust; has some canopy distribution as rust.

SBR ID card - Anne Dorrance, Ohio State Univ. (APHIS purchased 500,000)

Response

Initial detection in Louisiana

Nov. 6, 2004

Production farm
operated by LSU,
while looking at
Cercospora leaf blight



Federal, State,
University
coordinated ICS


Recovery

Soybean Rust

"2005 Coordinated Framework"

1. SBR Surveillance and Monitoring Network
2. Decision criteria for fungicide application
3. Web-based decision support system
4. Predictive models
5. Outreach

Recovery



United States Department of Agriculture

Soybean Rust
Information Site

Getting Started

[Prev](#) [Next](#)

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October - 2005

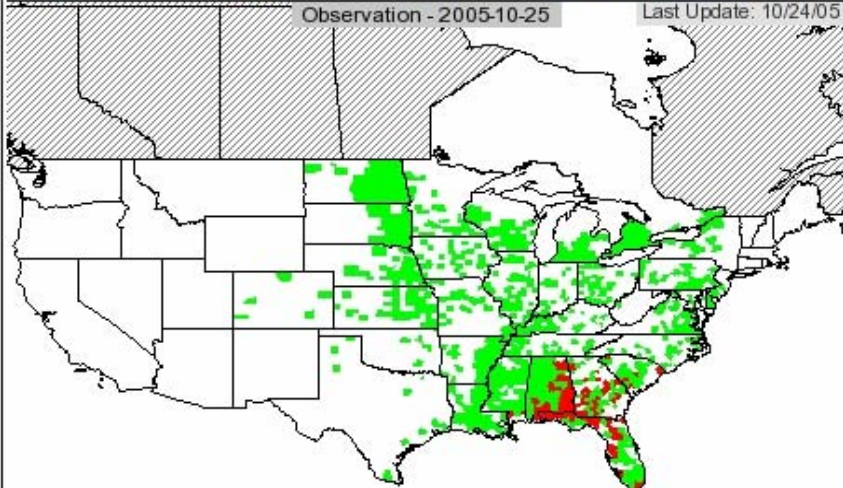
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20	21	22	23	24	25	26
27	28	29	30			

Map Description
- Overlay -
Load

Observation - 2005-10-25 Last Update: 10/24/05







Sign Up For Alerts

Oct 25, 2005

Observation



State Update Map



Chronology of Positive Detections

SBR Forecast (10/24/05)

Wilma moves across Florida with some soybean rust transport and depositions. [Click For Details...](#)

USDA Links

[APHIS-PPQ Soybean Rust Site](#)

[CSREES Web site](#)

[National Plant Diagnostic Network site](#)

[Return to: USDA SBR website](#)

[USDA Position on Spore trapping](#)

Printable Map

National Map Commentary (updated: 10/24/05)

Alabama has reported 10 new counties as positive: Chamber, Randolph, Clay, Marshall, Cherokee, De Kalb, Etowah, Russell, Bullock, and Barbour counties (see state commentary for more details). There are also new county finds in Duval county, Florida and Evans county, Georgia. Pickens County in South Carolina is the farthest north location and Horry county SC is the farthest east location where soybean rust has been found in 2005. Pearl River County in Mississippi is the furthest west that rust has been found in 2005. Alabama now has 26 counties reported positive with rust; Florida has 23; Georgia has 30; Mississippi has two; and South Carolina has five. There were 35 counties that reported soybean rust in the month of August with ten reports for September and twenty-five so far in October [one of the reported counties was confirmed in September]. As the growing season has finished or nearly finished in most regions, the threat of rust has diminished. It may be expected that rust will continue to be found in more counties within states already reporting rust and in adjacent states without causing any economic damage.

Additional Links

[Aerobiology Risk Analysis](#)

[American Phytopath Society Home Page](#)

[Animated Hurricane Maps](#)

[Soybean rust Identification card](#)

USDA is Providing Tools to Help Growers Manage SBR in 2006

A Cooperative Partnership Agreement was signed September, 2005:

- Risk Management Agency (provided funds)
- CSREES
- Southern Region Integrated Pest Management Center at NCSU

APHIS – An Emergency Response Agency

National Framework for Crop Biosecurity

1. Prevention

2. Preparedness

3. Response

4. Recovery

SBR Strategic Plan

Protection

Detection

Response

Recovery



Drawing courtesy of
Joel Floyd, APHIS-PPQ