

Soybean Rust

Q. What is soybean rust?

A. Soybean rust is caused by either of two fungal species, *Phakopsora pachyrhizi*, also known as the Asian species, and *Phakopsora meibomia*, the New World species. Affected plants are quickly defoliated, reducing pod set and pod fill, which results in reduced yields and seed quality.

Q. How does the fungus damage soybeans?

A. Scientists believe the soybean rust pathogen can have as many as five stages in its life cycle, though only three have been observed. Spore-bearing bodies of those three stages—uredinia, telia, and basidia—grow on the underside of infected leaves, below the epidermal layer. Infected leaves take on a brown, stippled look before losing chlorophyll and eventually dying. Under a powerful lens, fungal bodies look like little brown volcanoes.

Q. What does soybean rust look like on the plant?

A. Soybean rust is difficult to identify in the early stages of infection, as symptoms are very small, poorly defined, and occur in the lower-middle canopy of the plant, where it is humid. Early symptoms appear as a yellow mosaic discoloration on the upper surfaces of older leaves. As the disease progresses, leaves turn yellow, and brown or reddish pustules appear, generally on the bottom surface of the leaf.

Soybean rust infection may be mistaken for spider mite damage or foliar diseases such as Septoria brown spot, bacterial blight, or bacterial pustule. It is important to note that soybean rust pustules frequently lack the yellow halo associated with bacterial pustule. Unlike lesions from spot diseases, soybean rust pustules are raised, mainly on the underside of the leaf.

Q. How is soybean rust transmitted?

A. The fungus is spread primarily by windborne spores that can be transported over long distances. Seed-borne transmission has not been documented. Clouds of spores are released if infected plants are disturbed by wind or by individuals walking through rust-infected areas. Though tourists, live plant material, or mechanical transport on planes or ships could deliver soybean rust spores to the continental United States, spores blown in on wind currents are the most likely source of introduction for soybean rust to the U.S. mainland.

Q. How mobile is soybean rust?

A. Soybean rust spores can be carried long distances by wind currents. In 1998, spores were blown 1,350 miles down Africa from Uganda to Zimbabwe. Between 2001 and 2003, the disease spread more than 1,500 miles, from Paraguay to near the equator, infecting as much as 90 percent of Brazil's soybean acres on the way. Researchers believe soybean rust is as mobile as the sugarcane rust that blew into the Dominican Republic in 1978. In fact, many believe that soybean rust spread via wind currents from Asia to Africa, then to South America. Plant pathologists believe soybean rust is likely to spread much like wheat stem rust or Southern corn rust when *P. pachyrhizi* reaches North America.

Q. Where is soybean rust found?

A. As of April 2004, soybean rust had not been found in the continental United States. Asian soybean rust, *P. pachyrhizi*, the more aggressive of the two species, was first reported in Japan in 1903 and was confined in the Eastern Hemisphere until its presence was documented in Hawaii in 1994. Today, the disease occurs on some islands and most continents where soybeans are grown:

- Asia—China, Japan, the Philippines, Taiwan, India, and Eastern Russia
- Australia
- Africa—Uganda, Zimbabwe, Zambia, Rwanda, and other African nations
- South America—Paraguay, Brazil, Argentina, and Bolivia
- Hawaii
- The Caribbean (*P. meibomia* only)

Q. How destructive is soybean rust?

A. Soybean rust has devastated soybean crops in many parts of the world, with reported yield losses as high as 80 percent in some afflicted areas of Africa and South America. In Australian test plots where no fungicides were applied, yield losses reached 60 to 70 percent. In 2003, Brazilian producers lost \$1.3 billion to soybean rust, a figure representing lost yield and the cost of fungicides applied to combat further losses.

Q. What fungicide application schedule will work best for controlling soybean rust?

A. Researchers are designing a model to predict areas in the United States most susceptible to soybean rust. They believe this model will help to identify where soybean rust will most likely appear in the United States. The disease is difficult to detect in the early stages of an introduction. However, experience in South America, Africa, and Asia indicates that early detection and treatment are essential.

Q. What is the U.S. Department of Agriculture's (USDA) Animal and Plant Health Inspection Service (APHIS) doing to prevent the introduction of soybean rust here in the United States?

A. National and international scientists and researchers, including USDA experts, agree this disease will most likely be introduced into the United States by natural means through airborne spore dispersal; however, APHIS is working to delay the human-assisted introduction of the disease through its safeguarding program.

Q. What are the elements of APHIS' soybean rust safeguarding program?

A. APHIS has recently updated its strategic plan to minimize the impact of soybean rust introduction. The plan focuses our efforts on protection, detection, response, and recovery. To view the APHIS Soybean Rust Strategic Plan, visit our Web site at www.aphis.usda.gov/ppq/ep/soybean_rust/sbrplan12-03.pdf.

Q. Because the focus of the strategic plan is to minimize the impact of soybean rust, what actions has APHIS taken?

A. APHIS is assessing the risks associated with the introduction of imported soybean seed, meal, and grain.

Because of our excellent working relationship with the American Soybean Association (ASA), APHIS co-sponsored a soybean rust conference in January 2004 to disseminate information and to train more than 300 soybean producers, handlers, and consultants in soybean rust detection. Representatives from five major pesticide companies were also on hand to discuss fungicide mitigation.

Our academic partners at the University of Illinois and Iowa State University are developing models to predict the regions of the United States most susceptible to soybean rust. They believe this model will help to identify where soybean rust will most likely appear in the United States.

APHIS' pest detection staff is working with USDA's Cooperative State Research Extension and Education Service (CSREES) and its National Plant Diagnostic Network (NPDN), providing disease recognition and pathogen diagnostic tools.

- Several States are establishing soybean rust monitoring sites along the Eastern seaboard and within Southern States.
- We've also assembled a soybean rust detection assessment team composed of scientific experts and State and Federal regulatory officials who would come together to assess the nature and extent of the first outbreak of soybean rust in the continental United States.

Q. What's APHIS' current policy on imported soybean commodities?

- A.**
- While soybean meal, grain, and propagative seed are allowed into the United States, soybean plants are prohibited. Because the soybean rust pathogen is not a seed-borne disease, and it primarily affects the plant's stem, pods, and leaves, we've restricted the importation of all soybean plants from countries with the disease to further protect U.S. soybean crops.
 - Imported soybean seed intended for planting must be clean.
 - Grade soybean meal is a processed product. During processing, the meal is heat-treated, therefore eliminating spore viability. If foreign matter is removed prior to processing, and added back into the meal after processing, the matter must first be heat-treated.
 - Soybean grain is allowed into the United States with up to 2 percent foreign matter.
 - To date, there is no evidence supporting an assertion that soybean grain shipments, meeting our current import requirements, present a risk to U.S. agriculture.

Q. Given what we know about the devastation caused by soybean rust in Brazil and Argentina, why isn't APHIS protecting U.S. soybean farmers by imposing a ban on imported soybean meal, grain, and seed from those countries?

A. It's APHIS' mission to safeguard U.S. agriculture and natural resources. It wouldn't be prudent to impose a ban on imported soybean meal, grain, or seed without scientific data to support such a ban.

Q. Are soybean shipments inspected at ports of entry?

A. Yes. Department of Homeland Security Customs and Border Patrol officers inspect soybean seed and grain shipments to ensure compliance with import requirements.

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