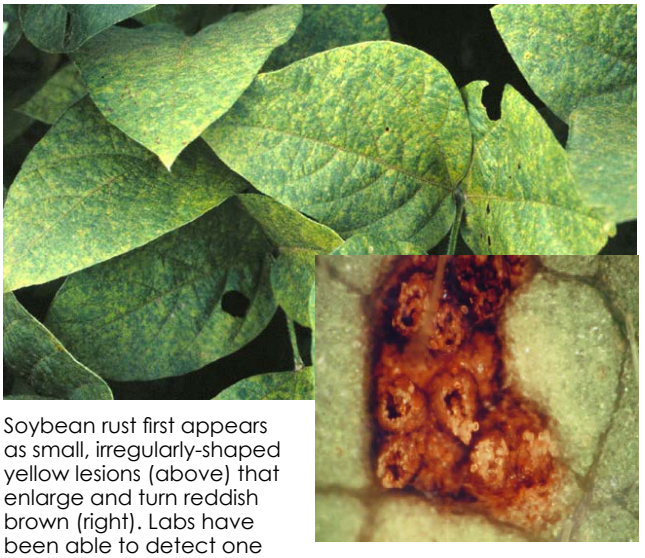
Emerging Soybean Rust Threat

This project has saved the soybean industry hundreds of millions of dollars and minimized human and environmental health risks by identifying soybean rust management strategies that protect soybean yields and optimize fungicide use.

Who cares and why?



Soybean rust first appears as small, irregularly-shaped yellow lesions (above) that enlarge and turn reddish brown (right). Labs have been able to detect one tiny SBR pustule out of 100 leaves, giving a heads up that scouting efforts should be intensified in certain areas and fungicide sprays could be necessary.

Soybean rust, a disease caused by the fungus *Phakopsora pachyrhizi*, was first discovered in the U.S. in 2004 and poses a serious threat to soybean production. The soybean industry is especially concerned because of severe yield losses from this disease in Africa and South America. In recent years, soybean rust (SBR) has spread throughout the southeastern U.S. and as far north as Canada, with some areas suffering high yield losses. Because the SBR pathogen is distributed by airborne spores, the disease can travel long distances quickly (Mexico and Caribbean islands harbor sources of the fungus even though below freezing winter temperatures kill off the disease in the U.S.). This potential for rapid spread calls for multistate, multidisciplinary coordination in order to respond rapidly to outbreaks and implement long-term strategies to prevent an epidemic. Despite many seasons of dealing with SBR, scientists still lack key information about the disease and how to best manage it. Because no U.S. soybean varieties are resistant to SBR, the disease has been managed primarily with increased fungicide applications. Though scientists and regulators have worked quickly to register and release selected fungicides in the U.S., farmers often spray too little, too late, or unnecessarily. Spraying too little can lead to severe yield loss from uncontrolled SBR, while spraying too much can raise the growers' costs, damage crop quality, pose risks to human and environmental health, and hasten fungicide-resistant disease strains. Furthermore, soybean producers often do not know when to spray; spraying too early (or when environmental conditions are not favorable for disease development) wastes spray, time, and money, while spraying too late may be ineffective. To keep the U.S. soybean industry profitable and competitive, scientists are trying to expand and standardize disease monitoring efforts, encourage cost-effective fungicide use, and develop viable long-term disease management strategies.

What has the project done so far?

NCERA-208 has been instrumental in building relationships among researchers, soybean growers, industry associations, and international partners in Canada and Mexico and mobilizing regional resources to provide a structured, efficient response to the emerging SBR threat. Over the past five years, scientists have closely tracked the disease using a network of over 2,300 "sentinel plots." Using the sentinel plot data, researchers have created maps and models to predict where SBR is likely to occur. In addition, NCERA-208 has assisted with registering a new class of fungicides, tested the efficacy of fungicides, and determined proper amounts and timing. Researchers have also made significant progress in identifying promising soybean lines with resistance to the rust pathogen. NCERA-208 researchers and extension specialists have provided many educational materials that have helped growers identify and manage SBR. These include scouting videos; field ID cards in English, Spanish, and French; radio and television appearances; telephone hotlines; websites; newsletters; and over 200,000 *Using Foliar Fungicides to Manage Soybean Rust* manuals (*http://oardc.osu.edu/soyrust/*). Scientists have also shared recent findings during conferences, workshops, and in over 50 peer-reviewed journal articles.

Impact Statements

Formed a network of soybean producers and industry personnel across the U.S., Mexico, and Canada, which has helped provide the up-to-date information needed to prevent major problems in the U.S.

Alerted the soybean industry when and where SBR was detected, thus saving North American soybean producers over $600 million in unnecessary fungicide costs, reducing chemical exposure to the environment and food supply, and diminishing apprehension among the soybean industry.

Prevented disease spread and soybean yield losses by designing maps, models, and hands-on training programs that enhanced farmers' ability to predict, detect, and control SBR early on.

Refined protocols for disease management that are being used to prevent yield loss in many different environmental conditions and levels of disease pressure.

Provided online data and state-specific recommendations, saving the soybean industry nearly $300,000,000 in 2005 alone.

Strengthened defenses against SBR and protected tens of thousands of soybean acres by determining the most effective fungicides and the right amount and time for spraying and working with state and federal agencies to make them available to farmers.

Discovered soybean varieties that have high levels of resistance to SBR—a key step towards more sustainable, long-term disease management.

Since 2006, hands-on training sessions in Quincy, Florida, have taught over 750 soybean specialists, crop advisors, industry associations, and farmers to diagnose SBR on soybean and other host plants.

What research is needed?

Expanded monitoring efforts are essential to ensure that fungicides continue to contain SBR spread. In order to prevent and combat outbreaks, scientists need a better understanding of the pathogen's genetic diversity, lifecycle (especially during winter), geographic range, and potential hosts. Scientists also need to improve methods for trapping pathogen spores and for determining if fungicide-resistant spores from Brazil could deposit in U.S. Research is needed to identify resistance genes and make resistant soybean varieties commercially available. Researchers also need to improve yield loss assessments and develop economic management strategies so that the soybean industry is more resilient if faced with serious outbreaks.

Want to know more?

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Compiled and designed by Sara Delheimer