MANAGING SOYBEAN DISEASES

Soybeans are an affordable, protein-rich legume with a wide variety of uses.

The U.S. is the world's leading soybean producer and exporter.

In recent years, yields have been stagnant in several areas largely due to the frequency and spread of soybean diseases spread by pests and fungal pathogens.

*In 2022, soybeans were planted on **87.2 million acres** in the U.S. (about 1/3 of all U.S. cropland) and had a total value of **$45.7 billion**.*

Without a variety of control strategies, farmers may waste time and money on ineffective options or unnecessarily use chemicals, which can pose human and environmental health risks and promote development of fungicide-resistant pathogens.

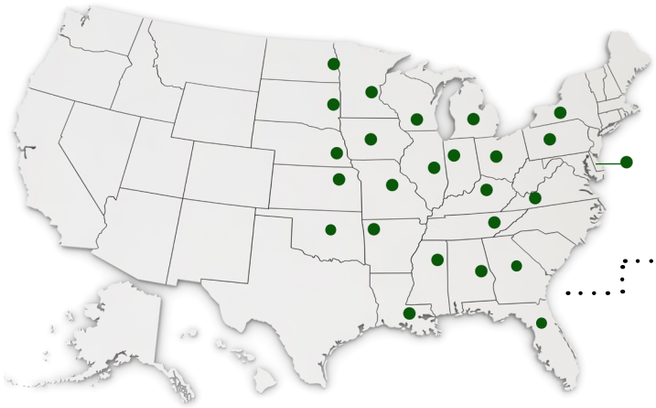
*Soybean diseases can cause losses of up to **$45 per acre**.*

Some diseases, like frogeye leaf spot, are more prevalent now due to warmer, wetter climate trends and increased use of no-till planting.

Some diseases, like soybean rust, spread in different patterns each year and are difficult to predict.

RESEARCHERS ARE TAKING ACTION

For more than 30 years, land-grant university scientists and Extension educators across the U.S. have worked together to address soybean diseases. The committee studies soybean and disease ecology, monitors soybean diseases, tests detection and control strategies, and shares information and tools with farmers, crop consultants, breeders, government agencies, and agricultural companies across the U.S.



*With members in **20+ states**, the group can compare disease status in different areas and test and share solutions widely. By providing a forum for regular communication, the project enhances the efficiency of soybean research and Extension and facilitates rapid response to issues.*

IMPACTS

Soybean variety tests and new disease-resistant varieties help crop consultants and farmers **SELECT AND PLANT BETTER SOYBEANS.**

*A Michigan soybean farmer reported a **20% yield increase** after choosing a variety resistant to southern root-knot nematode.*

Outreach provided science-based information to the soybean industry and **INCREASED USE** of effective solutions.

*The group creates fungicide efficacy tables that reach about **100,000 users** across **18 states** each year.*

New tools and products helped detect and control diseases, **PREVENTING SERIOUS DAMAGE, INCREASING SOYBEAN YIELDS,** and **SAVING FARMERS MILLIONS OF DOLLARS**. Mimizing farmers' costs and losses also **KEEPS SOYBEAN PRODUCTS CHEAPER** for consumers.

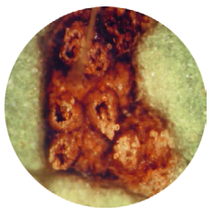
*Alabama farmers saved an estimated **$2.7 million** due to reduced yield loss from soybean rust after applying the right fungicide at the right time.*

*Tennessee farmers estimated saving **$7 million** in 2017 due to lower management costs and yield losses.*

Judicious use of chemical pesticides is **DECREASING HUMAN AND ENVIRONMENTAL HEALTH RISKS**.

With information about fungicide resistance, soybean farmers are **NOT WASTING TIME AND MONEY** on ineffective fungicide applications.

RESEARCH HIGHLIGHTS



UNDERSTANDING SOYBEAN DISEASES

Scientists are studying the biology and ecology of soybean diseases. For example, scientists in Alabama, Louisiana, and Mississippi teamed up to understand the fungus causing taproot decline while researchers in Delaware, Iowa, Louisiana, Michigan, Mississippi, North Dakota, Tennessee, and Wisconsin worked together to identify three novel species of Diaporthe fungi that cause seed disease. Other studies determined that soybean vein necrosis virus is spread mostly by soybean thrips, which are more abundant in dry weather.

Project members also looked at how specific farming practices affect soybean diseases. For example, Kansas researchers found that a pre-season mustard cover crop reduces charcoal rot severity. Another study in Kansas found that applying higher rates of phosphorus during corn years lessened the severity of sudden death syndrome in subsequent soybean crops. Michigan and Wisconsin researchers demonstrated that row spacing can dramatically reduce white mold. Studies in Delaware and Maryland showed that double-cropped soybeans may be affected more severely by soybean vein necrosis. Recently, research confirmed that GPS-guided planting of continuous soybeans has contributed to the emergence of taproot decline.

CHEMICAL CONTROL

Project members regularly test seed treatments and foliar fungicides to determine which are most cost-effective. Fungicide efficacy tables reach about **100,000 users** in **18 states** each year. In Alabama, researchers showed that a single well-timed fungicide application for soybean rust can increase yield by **15-20%**. After learning of these findings, farmers treated more acres with fungicide and saved an estimated **$2.7 million** in potential yield loss from soybean rust (after taking into account the application cost for the fungicide).

MONITORING SOYBEAN DISEASES

Project members designed better tools and methods for detecting soybean diseases, monitoring spread, and estimating risk. For example, researchers in Iowa and Kentucky showed how Twitter can be used to track soybean diseases. Wisconsin scientists developed the free Sporecaster app to help farmers predict white mold severity and determine when to apply fungicide. Since May 2018, the app has over **3,000 downloads**. The newer companion app, Sporebuster, calculates the economic return of deploying a white mold fungicide.

Researchers are also keeping an eye on fungicide-resistant diseases. For example, researchers in Kentucky and New York spearheaded an effort that identified fungicide-resistant strains of Cercospora sojina, which causes frogeye leaf spot, in **22 states**. Genomic analysis detected greater frequency of fungicide resistance among the pathogens that cause Septoria leafspot and target spot. Researchers also developed a tool that tracks fungicide-resistant pathogen populations.

SOYBEAN VARIETIES

Project members evaluate soybean resistance to disease. For example, in Michigan, researchers evaluate the susceptibility of soybean varieties to southern root-knot nematode each year. A farmer reported a **20% yield increase** after choosing a variety based on trial results. Scientists in North Dakota and South Dakota identified sources of resistance to the fungal pathogen Fusarium graminearum.

Researchers also bred numerous soybean varieties with stronger resistance. **Four varieties** with resistance to Sclerotinia sclerotiorum (which causes white mold) will be released in 2024.

Scientists in Illinois, Iowa, Minnesota, and Ohio improved the durability of soybean resistance.

EDUCATION & OUTREACH

Between 2015 and 2023, this committee produced **over 725** peer reviewed publications, proceedings, abstracts, and technical reports; **20** books or book chapters; and **more than 500** newsletters, videos, webinars, podcasts, news articles, and other extension products.

All project members contributed to the Integrated Pest Management Pest Information Platform for Extension and Education (IPM PIPE), which shows the spread of soybean diseases in real time and helps farmers make decisions.

Project members provided data and materials for the Crop Protection Network. The network's publications and decision-support tools have over **750,000 page views**.

North Dakota State University leads the Soybean Cyst Nematode Coalition, which has encouraged farmers to change the way they manage the disease. The coalition's efforts have saved growers an estimated **$100 million**.

Project members helped run "Beat the Pest. Take the Test, Version II," an outreach campaign that encouraged farmers to test for soybean cyst nematode and take appropriate actions.

During field days, grower meetings, and more, thousands of clients improved their knowledge about soybean disease management.

Project members trained farmers, pesticide applicators, government agencies, and others how to detect and monitor soybean diseases and fungicide resistance and how to select and use chemical fungicides.

PROJECT FUNDING & PARTICIPATION

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