

## Chapter 4

### The Sentinel Plot System: Monitoring Movement of an Invasive Pathogen

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#### Sentinel Plots in the United States

Sentinel plots are used to monitor airborne pathogens in other parts of the world, and disease-tracking systems are used to monitor other diseases in the United States. Soybean rust (SBR) sentinel plots are monitored in Brazil to predict risk. In the United States, cereal rusts and blue mold of tobacco are tracked each season. As part of the USDA-APHIS, the United Soybean Board (USB), the North Central Soybean Research Program (NCSRP), and state (or local) soybean check-offs, the progress of soybean rust development was monitored during 2005, 2006, and 2007 and will be monitored in 2008 with a total of 574 sites in 35 states. Five Canadian provinces are also involved in the monitoring effort in 2007. A single soybean rust monitoring protocol has been developed for all sentinel plots included in this system.

The sentinel program for monitoring SBR in North America has three objectives. The primary objective is to serve as a warning network for tracking the spread of the disease in North America. For this reason, and because the pathogen can only over-winter in subtropical regions, southern and Mississippi Valley states have more sentinel plots relative to their soybean acreages than states in other regions. The

second objective is to quantify the timing and amount of spore production in over-wintering and growing-season source areas, an important input for the SBR aerobiology prediction system. A third objective of the sentinel plot system is to collect data for epidemiological research. For this reason, sentinel plots should be maintained after first detection unless other considerations dictate otherwise. The decision to destroy sentinel plots after detection is left to each state.

In each participating state or province, multiple locations are planted to one acre or less of several maturity groups up to approximately one month prior to commercial soybean planting (Figure 4.1). The greatest risk for disease development is during the reproductive stages of soybean development (first bloom to pod fill), and scouting should be intensified during this time. Monitoring of sentinel locations is year-round in the southern United States. During the winter months, kudzu (Figure 4.2) and other legumes are also monitored for SBR development. After SBR is detected, the decision to continue to monitor disease development in the sentinel plot is left to the individual state.



Figure 4.1. Scouting soybean sentinel plot in Georgia. Photo by Layla Sconyers. Used with permission.



Figure 4.2. Kudzu in protected area with over-wintering soybean rust. Photo by Tim Flanders, UGA Cooperative Extension. Used with permission.

Sentinel plot monitoring in many states is being done by each state's county Extension educators/agents. These individuals have been trained on how to identify soybean rust and other common diseases of soybean (Figure 4.3). Due to the difficulty of detecting

SBR at low incidence and severity, many states have their cooperators mail leaf samples to a central diagnostic lab where the leaves are incubated prior to observation with microscopy.

Data from all sentinel plots are uploaded to the USDA's SBR-



Figure 4.3. Dr. Greg Shaner, Purdue University, searching for soybean rust. S. Conley, University of Wisconsin. Used with permission.

Pest Information Platform for Extension and Education (PIPE) web site. In each state, the monitoring program is supervised by the state Extension soybean pathologist. Soybean rust data are entered into a database as part of the PIPE program. Data entered into this system are used for refining disease-forecasting models. Counties that have been scouted with no soybean rust detected are colored green, while counties where rust has been detected are colored red. All detections, including samples from diagnostic clinics, are also entered into this database. This system provides a real-time representation of soybean rust and scouting efforts. The data are used by the state Extension specialists in making recommendations for fungicide applications.

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### Utilization of Spore Traps in Predicting Soybean Rust Spread

As part of a study conducted by Syngenta Crop Protection and the University of Arkansas, spore traps (Figure 4.4) have been placed (in 2005, 2006, and 2007) in sentinel plots throughout participating soybean-producing states. The traps are used to collect rust spores onto a petroleum-jelly-coated microscope slide. The purpose of this study is to determine if these spore traps could be used to provide an additional warning tool for soybean rust by detecting the presence of rust spores that may lead to the development of the disease. The implication of finding spores in these traps is unknown at this time in the United States because

spores of soybean rust cannot be reliably distinguished from spores of some other fungi by visual examination only. The decision to release information pertaining to spore detection has been left up to each state specialist. Even when we can confirm that the spores are soybean rust, we are uncertain of the viability of the spores found in the traps. Research has shown that there are lethal effects of ultraviolet radiation and desiccation while spores are transported in the air; these will vary significantly as a result of weather.

Currently, the spore traps provide an indication that soybean rust spores may be in the area. This does not

necessarily mean that soybean rust will develop. In 2005, “soybean rust-like” spores were detected as far north as Minnesota and Canada, yet soybean rust never developed north of Kentucky. In 2006, “soybean rust spores” were detected across the Great Plains into the Dakotas, and rust did not develop. At present, researchers are trying to improve their ability to identify the correct species of the spores that are recovered in these traps. Since this disease has the potential to spread quickly, there is a need for a quick field diagnosis. Researchers are currently working on the development of more rapid field diagnostic tests (*e.g.*, ELISA quick strips).



Figure 4.4. A Syngenta spore trap.