

Chapter 5

Sentinel Plots in the United States: Modeling the Seasonal Spread of Soybean Rust in North America

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The goal of soybean rust modeling is to provide state plant pathology Extension specialists with an unprecedented level of support for tracking the spread of the disease during each growing season. In turn, these specialists interpret the model predictions in light of current disease distribution and intensity to help growers make informed scouting and fungicide application decisions for soybean rust control.

The modeling team tracks soybean rust much the same way that the National Hurricane Center tracks tropical cyclones. The modelers use what is known as an ensemble approach to follow the movement and development of soybean rust across the continent. In this approach, outputs from multiple computer models are merged to give a single disease prediction that is then used by Extension specialists to inform clientele about soybean rust risk and the potential for epidemics. The ensemble approach was adopted for soybean rust because it achieves reliable forecasts at a greatly reduced cost in time and effort. In addition, the interpretation of model predictions by a trained meteorologist results in the desired human-machine mix, thereby minimizing the limitations of individual models and maximizing their strengths.

Three very different types of computer models are

used to track soybean rust in North America. The Integrated Aerobiology Modeling System (IAMS), developed by Pennsylvania State University and ZedX, Inc., scientists, follows the disease development cycle that can lead to the geographic spread of soybean rust. The IAMS uses observations from the sentinel plot network and mobile scouting to estimate the production of spores at locations known to be infected with soybean rust. A transport component predicts aerial movement of spores, their survival during transport, and likely areas of spore deposition. Following deposition in an area, additional model components provide information on when soybean rust symptoms are likely to be expressed and on disease severity.

A second model, the HYPPLIT atmospheric transport model maintained by the NOAA Air Resources Laboratory, uses real time and forecast meteorological data to predict long-range transport, dispersion, and deposition of soybean rust spores from specific locations over subsequent days. A third soybean rust model, constructed by researchers from Iowa State University and St. Louis University, uses a climate model to predict which areas of the country are most likely to be at risk from soybean rust over subsequent weeks and months.

Like the meteorologists in the National Hurricane Center, the soybean rust forecasting team provides integrated, timely, easy-to-understand maps, drawn from the best information available. The job

of interpreting the ensemble forecast maps is left to Extension specialists who are familiar with the people and the situation in their respective states.

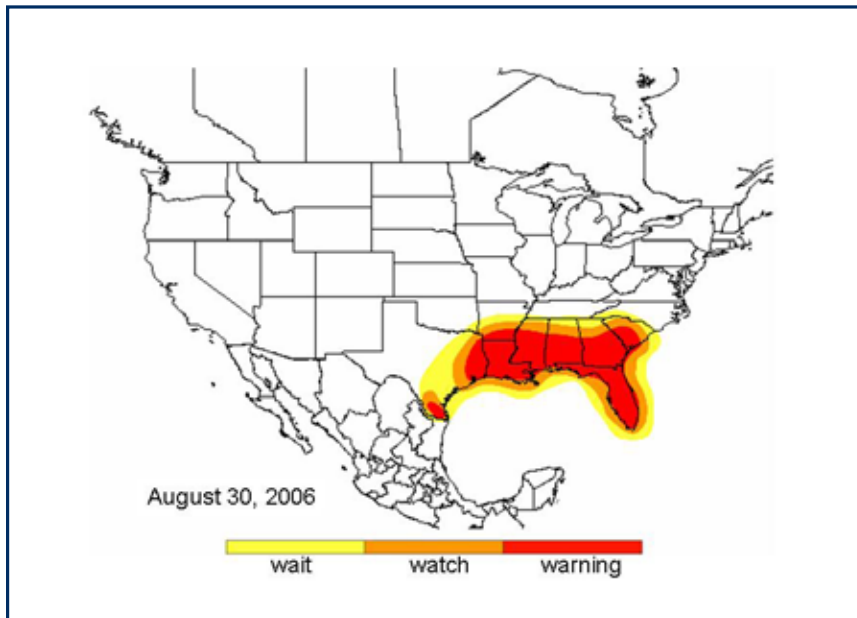


Figure 5.1. National Weather Service terms for severe weather risk are used on maps depicting risk from soybean rust. The ensemble forecasting team provides this information to the state plant pathology Extension specialists on a regular basis.

Forecasting the Risk from Soybean Rust

Ensemble meteorological forecasts combine output from different types of models to create a realistic picture of what weather we should expect in the next few days. In the case of soybean rust, the ensemble forecasts assess the probability that a spore transport event, and subsequent spread of soybean rust, will happen in the near future.

Overall risk from soybean rust is communicated to the public on the SBR-PIPE public web site (www.sbrusa.net) as three text forecasts: a summary of current conditions, a one- to three-day forecast, and a forecast of the risk three to five days into the future. Soybean rust risk for a specific state is communicated to the public by state Extension specialists. Their risk assessment is based upon a range of ensemble map and text forecasts provided to them by the soybean rust forecasting team.