

Ensemble Approach to Soybean Rust Forecasting for the 2006 Pipe

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The Pennsylvania State University

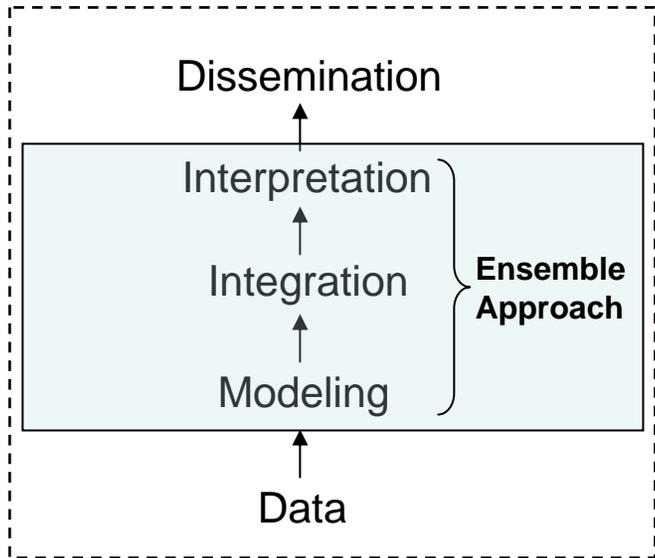
University Park, PA

2006 National Soybean Rust Symposium

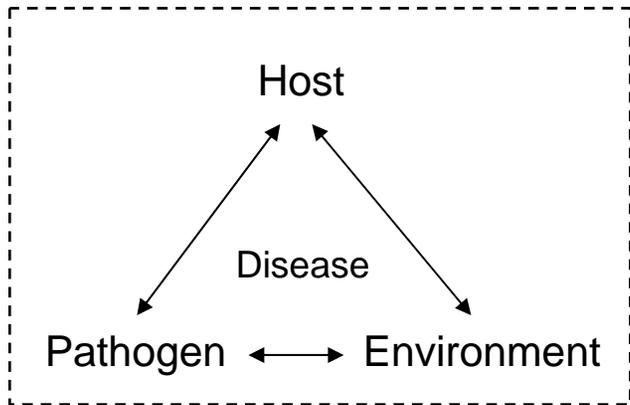
St. Louis, MO

November 30, 2006

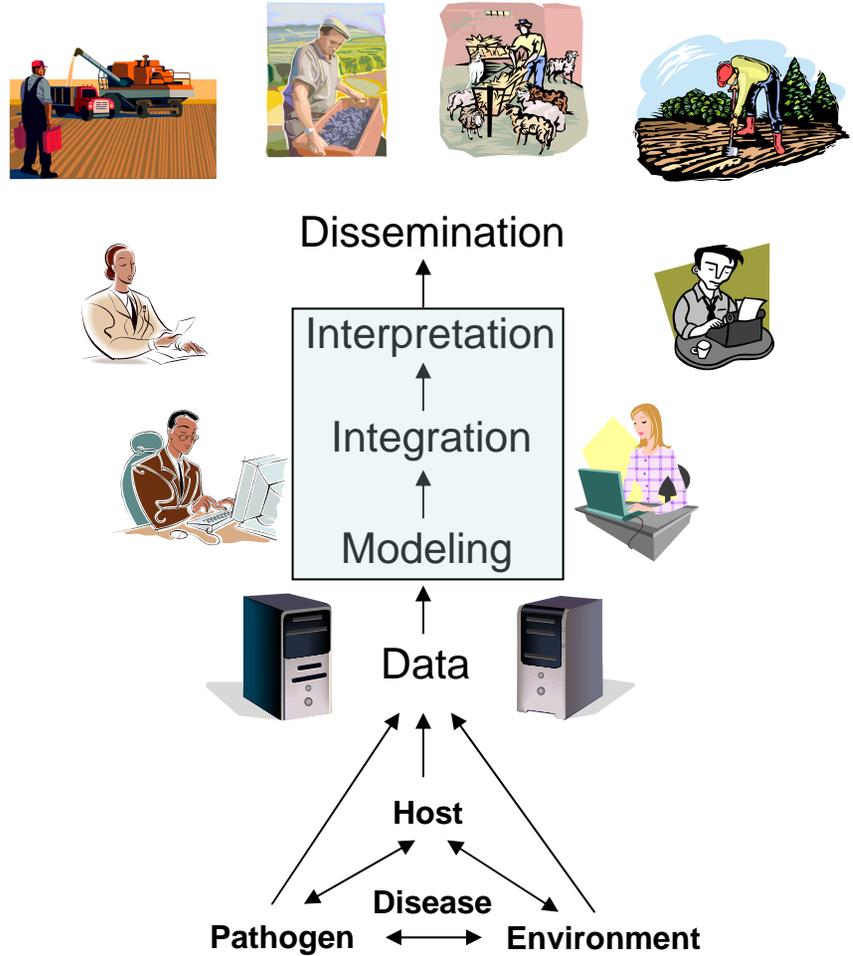
Ensemble Approach in the IT Paradigm for Plant Pathology



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Why Ensemble Forecasts

Ensemble forecasts are designed to capture the *probabilities* for weather events and the range of *uncertainty* inherent in each forecast situation so that the forecaster knows what to convey to the public.

Source: UCAR/COMET. 2004. Ensemble Forecasting Explained.

Ensemble Products

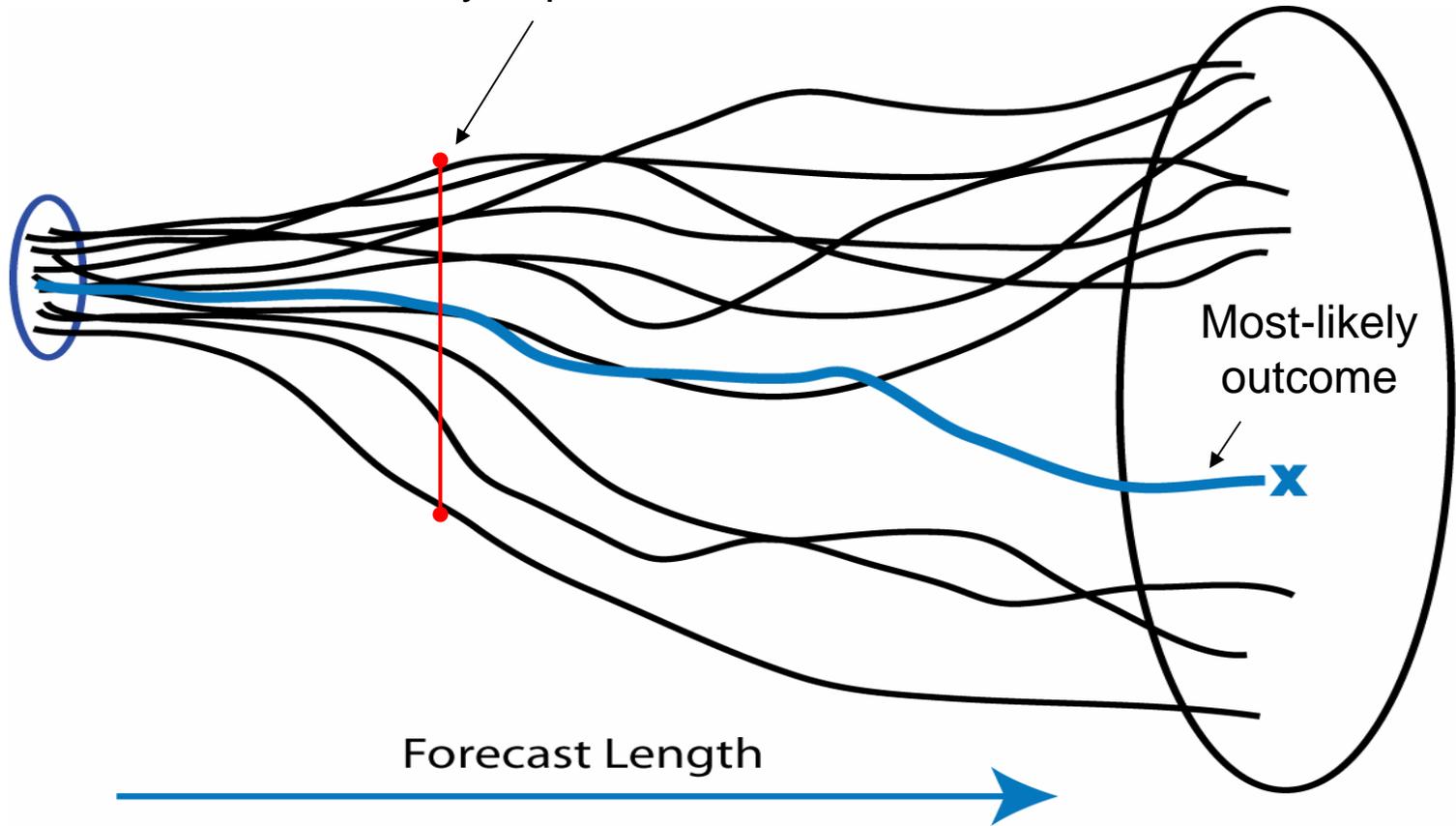
Ensemble products use various statistical and graphical methods to combine multiple model runs, which can be based on one of the approaches. Ensemble products can include information about the *level of uncertainty*, the most likely forecast outcomes, and the *probabilities* of those outcomes.

Source: UCAR/COMET. 2004. Ensemble Forecasting Explained.

Ensemble Products

Example of a Spaghetti Plot

Forecast ensemble represents range of uncertainty in predicted weather event



Most-likely outcome

Forecast Length

Ensemble Forecasting Approaches

- Vary initial conditions of a single model.
- Vary numerical methods of a single model.
- Vary physical parameterization of a single model.
- Combine output from multiple models.
- Combine output from multiple models plus human interpretation (used by National Hurricane Center).

The goal of the ensemble approach for the soybean rust forecasting is to provide trained interpreters meteorological output from multiple numerical weather prediction models and disease movement and severity output from multiple pest prediction models.

Legume PIPE (Interpreter Screen)

USDA Restricted PIPE Website - Microsoft Internet Explorer

USDA **interpreter** Edit Profile Tools Menu

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State Point
County Commentary

- Overlay - Load

SB Rust Raw Data - 2006-09-05

scouted, not found scouted, suspected scouted, confirmed
 Sentinel + Lab ▲ Industry ● Other

Sep 05, 2006

Legumes/Kudzu
Soybean Rust

Chronology of Positive Detections

SB Rust Raw Data

SBR Activity Ensemble

SBR Combo Ensemble

SBR Transport Ensemble

National Soybean Rust Commentary (updated: 09/05/06)

Soybean rust was reported on soybeans in a sentinel site in Colquitt County, Georgia (9-05). Currently rust has been found infecting this year's soybeans in 19 different counties in seven states: AL, FL, GA, LA, MS, SC, and TX. Including reports on kudzu, there is a total of 38 counties in seven states with rust this year including five in Alabama, 13 in Florida, eight in Louisiana, seven in Georgia, one in Mississippi, and two in Texas and South Carolina. Spore trapping continues throughout the U.S. using both active and passive traps. Any positive spore trap information does not imply infection has taken place and plant samples are used exclusively for recording positive rust occurrence. Recent shower activity has been reported in some of the infected areas and local infection has increased in some cases. Much like the 2005 season, more soybean rust finds are expected late this season through the next several months. Please consult your state commentary

Management Toolbox
[See Public Site](#)

- SBR Research Forecast
- SBR Public Forecast
- **National Commentary**
- Hurricane Animations
- ID/Scouting Tools
- Management
- Not sure if it is Rust?
- Observation Animations
- Other SBR Sites
- Partners

Done Internet

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State Point
County Commentary

- Overlay - Load

GFS Precipitation - 2006-09-05

24 hour Precipitation (inches)

0.01 0.1 0.25 0.5 0.75 1.0 1.5 2.0 3.0 4.0 5.0 6.0 8.0 10.0

GFS Precipitation

NAM Precipitation

GFS Relative Humidity

NAM Relative Humidity

GFS Solar Radiation

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Soybean Rust Research Forecast (issued: 2006-09-04)

Current Conditions

The boundary between sultry air over the Gulf States and Southeast and a cooler air mass in the northern tier remains active with clouds and showers. Only spotty showers are occurring across the interior Northeast, but a widespread area of rain and thunderstorms is migrating east along the front in north Texas and southern Oklahoma. A few showers mark low pressure near Chicago. The northern and central Plains are dry and pleasant.

Risk Factors: Thunderstorms developing over Florida, eastern Georgia and South Carolina will promote deposition in these areas; however winds are light and somewhat variable, though

Management Toolbox

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State Point
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GFS Wind - 2006-09-05

Average Mid Day Wind Speed (m/s) and Wind Direction

GFS Wind

NAM Wind

Precip / Rel. Humidity

Solar Rad. / Min Temp.

Wind Speed / Direction

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NAM Wind - 2006-09-05

Average Mid Day Wind Speed (m/s) and Wind Direction (→)

5 10 15 20 25 30 35 40

GFS Wind

NAM Wind

Precip / Rel. Humidity

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County Commentary

- Overlay - Load

Sim Acc Wet Dep Land - 2006-09-05

Spores/Land Area (#/ha)

0 10⁰ 10¹ 10² 10³ 10⁴ 10⁵ 10⁶ 10⁷ 10⁸ 10⁹ 10¹⁰ >10¹⁰

Sim Daily Spore Transport

Sim Daily Wet Dep Land

Sim Acc Wet Dep Land

Sim Lead Non Soy LAI

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County Commentary

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SBR Combo Ensemble: 1 - 2 Day Forecast (2006-09-04)

Transport Deposition Potentially Infected

SBR Combo Ensemble

SBR Transport Ensemble

SBR Deposition Ensemble

SBR Dis. Sev. Ensemble

GFS Precipitation

SBR Research Forecast

- [SBR Public Forecast](#)
- [National Commentary](#)
- [Hurricane Animations](#)
- [ID/Scouting Tools](#)
- [Management](#)
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- [Other SBR Sites](#)
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Soybean Rust Research Forecast (issued: 2006-09-04)

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County Commentary

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SBR Activity Ensemble: 1 - 2 Day Forecast (2006-09-04)

Chronology of Positive Detections

SB Rust Raw Data

SBR Activity Ensemble

SBR Combo Ensemble

SBR Transport Ensemble

Soybean Rust Public Forecast (issued: 2006-09-04)

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Risk Area: A slight increase in risk is expected in South Carolina and Georgia due to limited sunshine and more showers. Risk increase is also expected for adjacent counties of infected

Management Toolbox
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<p>Down</p> <ul style="list-style-type: none">- SBR Research Forecast- SBR Public Forecast- National Commentary- Hurricane Animations- ID/Scouting Tools- Management- Not sure if it is Rust?- Observation Animations- Other SBR Sites- Partners- Professional Societies- Soybean Rust: Scout Before you Spray	<p style="text-align: center;">Soybean Rust Public Forecast (issued: 2006-09-04)</p> <p>Current Conditions</p> <p>The boundary between sultry air over the Gulf States and Southeast and a cooler air mass in the northern tier remains active with clouds and showers. Only spotty showers are occurring across the interior Northeast, but a widespread area of rain and thunderstorms is migrating east along the front in north Texas and southern Oklahoma. A few showers mark low pressure near Chicago. The northern and central Plains are dry and pleasant.</p> <p>Risk Area: A slight increase in risk is expected in South Carolina and Georgia due to limited sunshine and more showers. Risk increase is also expected for adjacent counties of infected areas in the Florida peninsula as showers and thunderstorms develop. Visitors are encouraged to check the Observation and State Update screens on this web site to follow the progress of sentinel plots and scouting in their local areas. Visitors are also encouraged to frequently consult the Forecast Outlook and Disease Management commentaries supplied by state soybean specialists.</p> <p>1 - 2 Day Forecast</p> <p>September 5-6</p> <p>Disturbed weather will migrate southward through eastern Texas and parts of western Louisiana. A front pushing slowly east through the Carolinas will keep the shower risk high. Showers farther north will be migratory and should pass from the region by Wednesday afternoon. Generally dry and mild conditions will dominate the Great Lakes, Midwest and Ohio Valley. Risk Area: An increase in the risk is expected across east Texas and western Louisiana as showers and thunderstorms develop, light to moderate winds come from the southeast and sunshine remains limited. Risk will also stay high in eastern and central Georgia and South Carolina due to continued showers. Visitors are encouraged to check the Observation and State Update screens on this web site to follow the progress of sentinel plots and scouting in their local areas. Visitors are also encouraged to frequently consult the Forecast Outlook and Disease Management commentaries supplied by state soybean specialists.</p> <p>3 - 5 Day Forecast</p> <p>September 7-9</p> <p>Showers will diminish in the Southeast and near the Gulf Coast as high pressure builds east across the Tennessee Valley. A warming trend will commence in the central Plains, mid-Mississippi Valley and Ohio Valley as winds begin to blow from the southwest. Some showers will develop ahead of a significant cold front that will be moving into the upper Lakes. Risk Areas: Little significant change is expected over much of the region, except in Florida where continued thunderstorms will contribute to slow spread into adjacent counties. Visitors are</p>	<p>SBR Transport Ensemble</p> <p>Management Toolbox</p> <p>See Public Site</p>
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Done Internet

Thank you!

Questions?