

12.6 DEVELOPMENT OF WEATHER AND CLIMATE DECISION SUPPORT TOOLS FOR AGRICULTURAL APPLICATIONS

Mark Brooks*, Barbara Shew[†], Aaron Sims, Adam Baker, Ryan Boyles, and Sethu Raman
State Climate Office of North Carolina

[†] Department of Plant Pathology
North Carolina State University, Raleigh, NC 27695-7236

1. INTRODUCTION

Agriculture is one of the top ten revenue producing industries in North Carolina accounting for 22 percent of the state's income and 18 percent of the workforce. North Carolina ranks fourth in the nation for peanut production. In 2004, NC peanut production was worth \$77 million.

Disease prevention is an integral part of crop management. Appropriately timed chemical applications can mitigate yield losses by preventing disease onset, but should only be used when environmental conditions favor disease development. Over-application can exacerbate non-target problems.

Weather-based disease advisories take advantage of the close relationships between disease outbreaks and weather by allowing growers to skip or delay fungicide sprays during periods of unfavorable disease development.

Two major diseases that concern peanut growers include peanut leaf spot and Sclerotinia blight. If uncontrolled, peanut leaf spot can cause yield losses of 50 percent or more in one season. Sclerotinia blight can spread rapidly under a peanut canopy and result in yield losses of up to 80 percent in severe cases.

A method has been developed to automatically produce leaf spot and Sclerotinia disease advisories each morning. These advisories are forwarded to County Extension Agents for dissemination to growers.

1.1 NC CRONOS / ECONet Database

During the 2005 growing season, daily peanut disease advisories were generated using data from the NC ECONet** (a weather monitoring network maintained by the State Climate Office of

NC). These data are available via the State Climate Office's NC CRONOS[‡] Database, providing access to real-time, hourly data networks of over 300 weather stations in and around North Carolina (Figure 1).

2. METHODOLOGY

Each morning, the advisories were formulated for 13 locations in North Carolina using the concept of the disease triangle (Figure 2). The advisories are based on published research-based algorithms that compute the number of favorable hours for disease development (Cu and Phipps, 1993; Phipps et al., 1997; Langston et al., 2002). The algorithms consider specific environmental conditions such as air temperature, soil temperature, daily precipitation and relative humidity. Based on predetermined thresholds of these parameters, the daily count of favorable hours is incremented. Once a sufficient number of favorable hours have accumulated, conditions for disease development exist and an affirmative spray advisory is generated. If conditions do not yet exist for disease development, the advisory contains pertinent details for the grower including growing degree days and other statistics.

3. BENEFITS

Depending on the growing season and location, the number of spray applications can be significantly reduced, thereby saving money and reducing non-target effects. During the 2005 growing season, the leaf spot advisories saved 1-2 fungicide sprays in most locations translating into potential economic savings of up to 2.2 million dollars. Adapting this methodology to develop

* *Corresponding author address:* Mark S. Brooks,
North Carolina State University, State Climate Office,
Raleigh, NC 27695-7236; e-mail:
mark_brooks@ncsu.edu

** North Carolina Environment and Climate
Observing Network.

[‡] North Carolina Climate Retrieval and Observations
Network of the Southeast.

<http://www.nc-climate.ncsu.edu/cronos/>

decision support tools for other crops will extend these economic benefits to other agricultural interests.

4. LOOKING AHEAD

The State Climate Office of North Carolina is developing valuable, innovative products for the agricultural community. Plans are being implemented for the development of weather-based decision support tools for management of other crops including apples and peaches.

Additional tools under development include using numerical models to generate high-resolution analyses and forecasts. The model output will blend with existing NC ECONet stations to provide information in locations where stations do not exist and provide insight into impending conditions via forecast advisories.

A comprehensive website focused on agriculture will be operational in 2006.

5. REFERENCES

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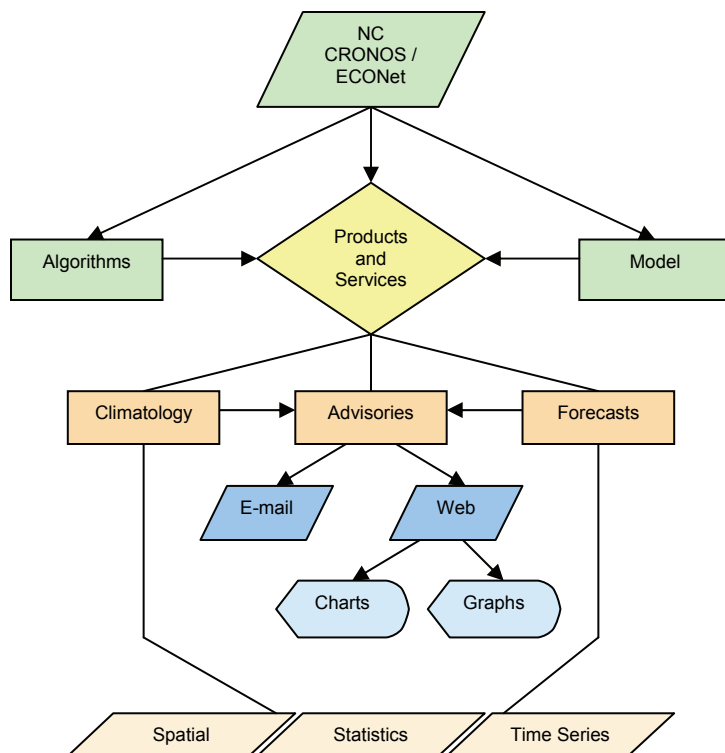


Figure 1. The State Climate Office of North Carolina's agricultural products and services are driven by a culmination of sources and needs. Climatology and forecast products feed real-time products, such as advisories. Advisories assist the client in making weather-based time sensitive decisions.

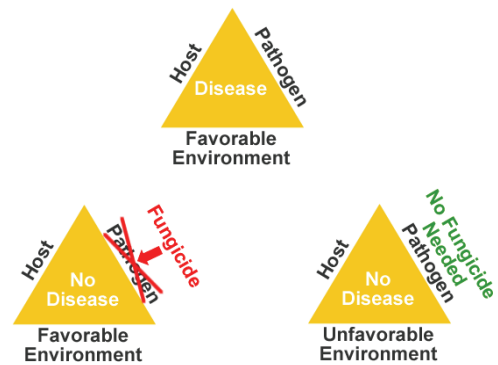


Figure 2. Disease advisories are based on the disease triangle. Disease will develop only if a pathogen encounters a susceptible host in a favorable environment. Applying a fungicide controls disease by removing the pathogen, but no fungicide is needed if conditions are not favorable for disease development.