

Efforts to Monitor the Dispersal of Soybean Rust

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Brief Outline

- Introduction
 - Why monitor the dispersal?
 - Examples of spore trapping in other systems?
- Spore trapping efforts for soybean rust
 - Local dispersal
 - Long distance dispersal

Why Monitor for Soybean Rust?

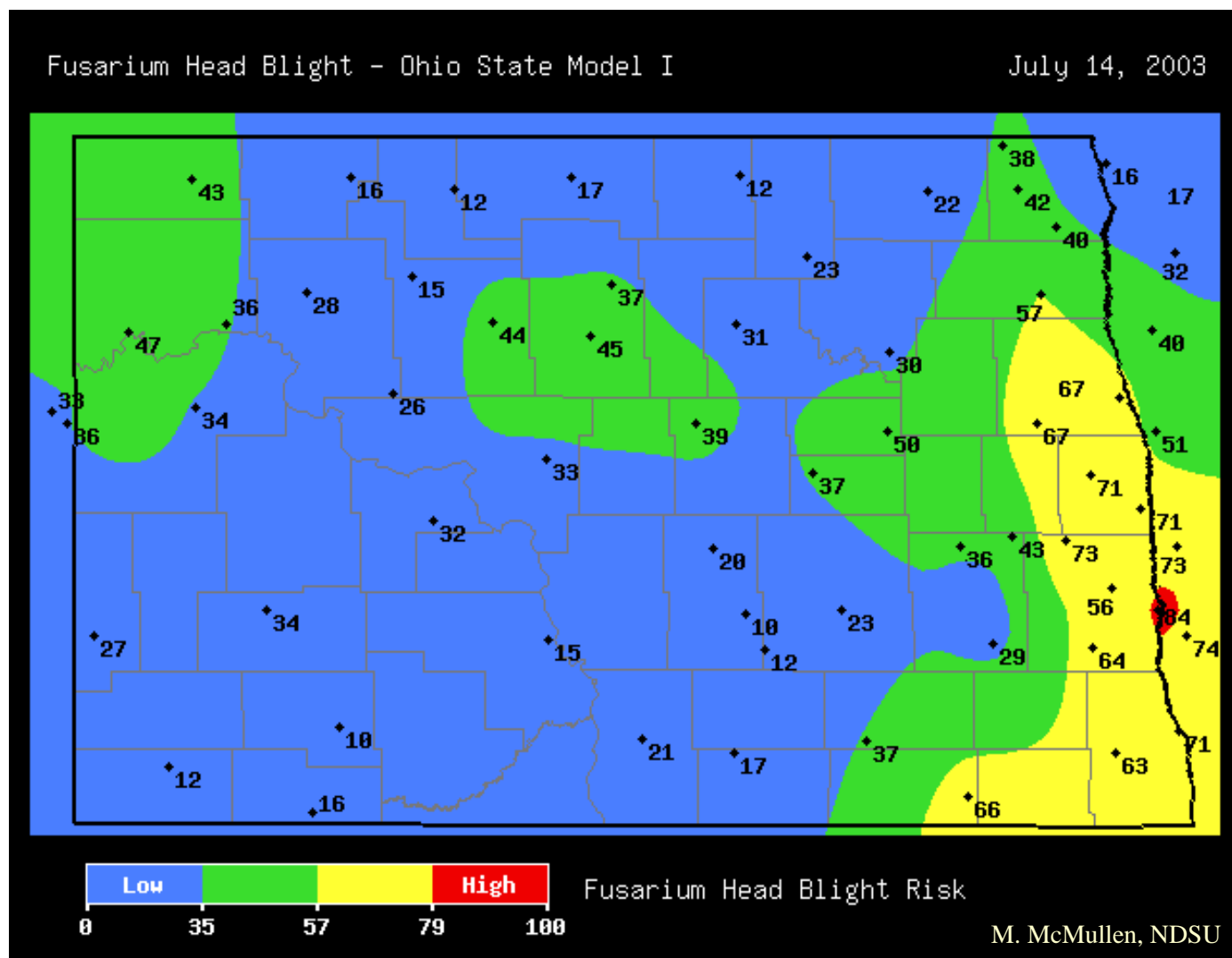
- Potential for early warning system
 - Alert growers of significant dispersal events prior to symptom development
 - Validation of aerobiology models for spore transport
 - Modeling goal to enhance spatial resolution of local obs
 - Possible to eventually replace spore traps?

Examples Pathogen Monitoring

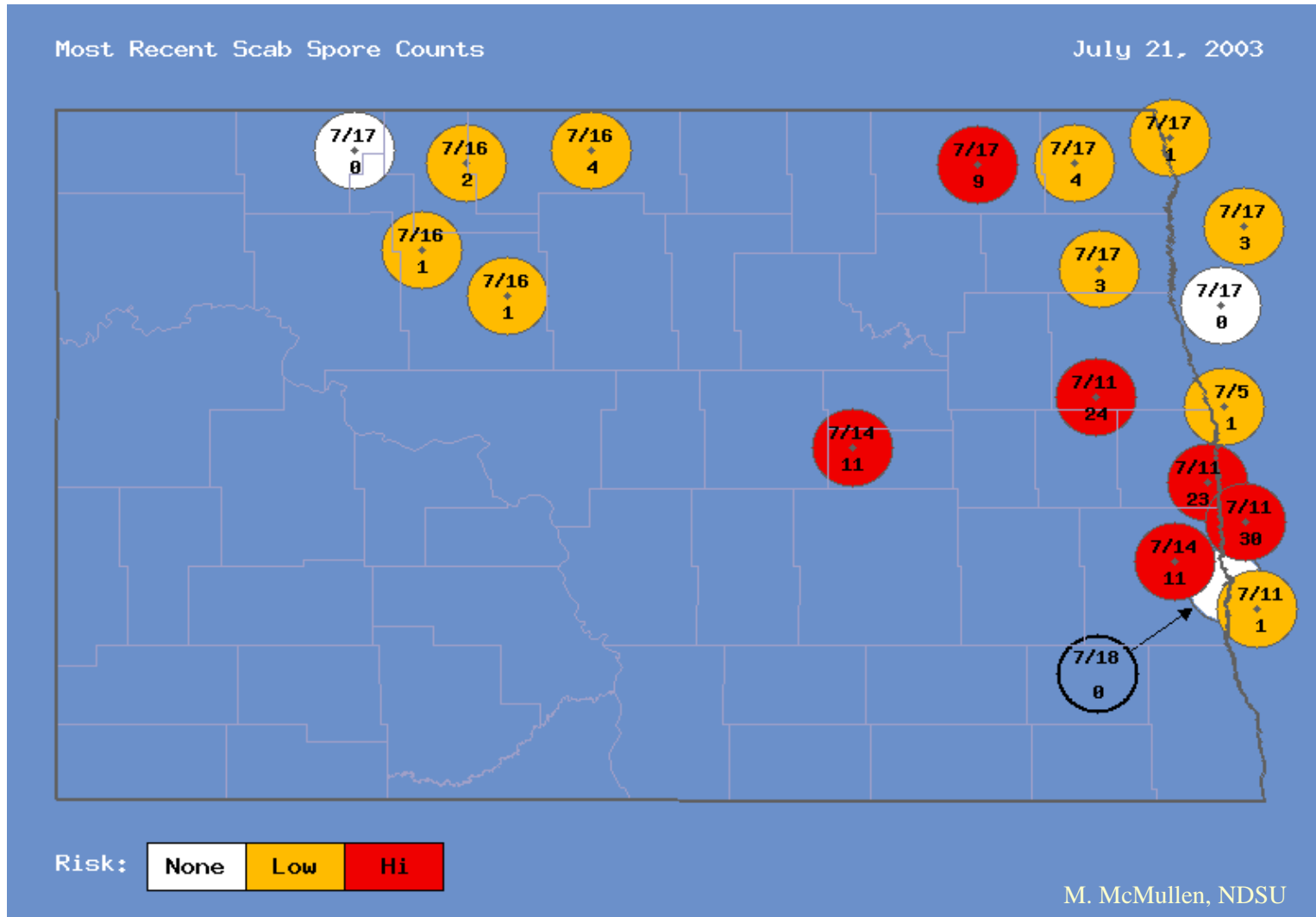
- NDSU Small Grains Forecasting System
 - Provides predictions for four diseases of wheat
 - Monitoring for *Gibberella zeae* ascospores and macroconidia to predict risk of head scab
 - Spore monitoring can be combined with models of pathogen reproduction



NDSU Small Grains Forecasting System: Risk of Pathogen Reproduction



NDSU Small Grains Forecasting System: Spore Monitoring



Key Differences

<i>Factor</i>	<i>Head Scab</i>		<i>Soybean rust</i>
	<i>Eastern U.S.</i>	<i>Northern state</i>	<i>Southern state</i>
Potential for local survival	High	Low	Moderate (High)
Source of initial inoculum	Local (Regional)	Distant	Local (Regional)
Importance of inoculum timing relative to host growth	High	High	High
Potential for Secondary cycles	Low	High	High

NDSU Experience

- Growers value information about the presence of spores
- Detection of inoculum is reasonable
- Difficult to translate number of spores trapped into clear risk of disease (infection efficiency of inoculum)
- Combination of prediction models and spore monitoring effective

Realistic Expectations for Soybean Rust

- Relationship between inoculum and disease took multi-state effort to develop initial concepts
- Several more years of operational use before pathologists and growers gained sufficient confidence
- Expect some growing pains with soybean rust

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Monitoring Local Dispersal

- Monty Miles, Glen Hartman and Scott Isard
- Ray Schneider, and Paul Mumma
 - Objectives
 - Evaluate different methods of spore trapping to assess local movement of the pathogen
 - Examine relationship between trapped spores and disease development

Types of Spore Traps

- Trap type

- Burkard vortex
- Burkard tape
- Rotorod (model 20)
- Passive trap (greased slide/EM stub)
- Super sniffer

- Method of Quantification

- Light or EM microscope
- RT-PCR



Spore Monitoring Progress

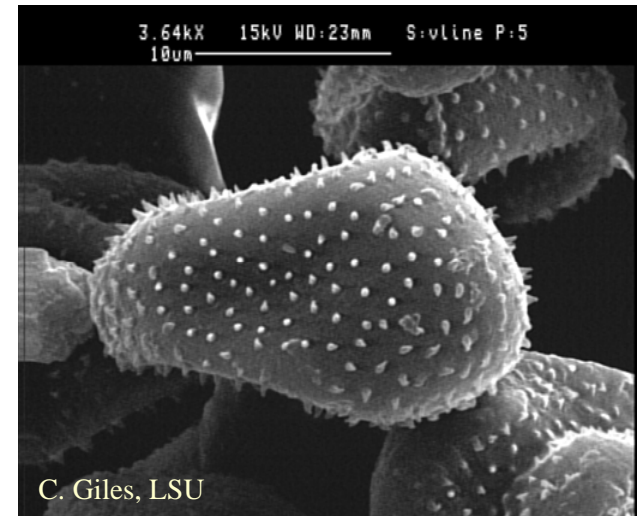
- Monitoring fields with soybean rust in FL, AL and GA
- Diurnal patterns in spore release within and outside crop canopy
- Relationship of spore release with weather variables
- Dispersal distance from known point sources with different trap types



Results To Date

Urediniospore on EM Stub

- Trapping successful
 - Multiple trap types and on many surfaces
- Spore counting is still on-going
 - Spore catches during mid-morning and early afternoon greater than at night
 - Presence of dew is key limiter of spore release



Results of PCR Quantification

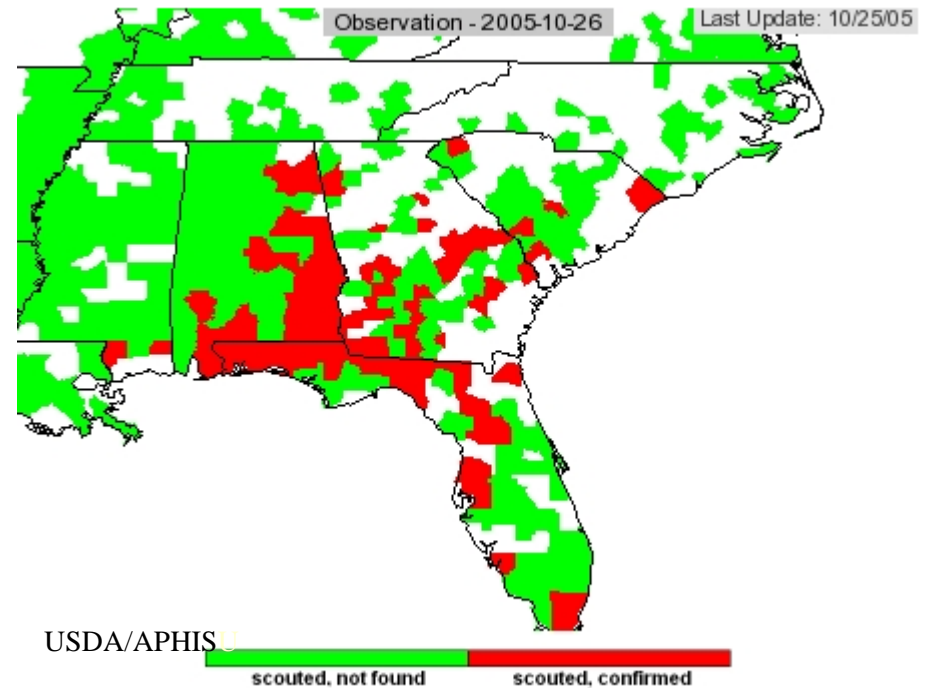
- RT-PCR methods detect ~10 spores
 - Detection in the presence of silicon grease
 - Calibrating spore numbers with RT-PCR

Plans for Continued Work

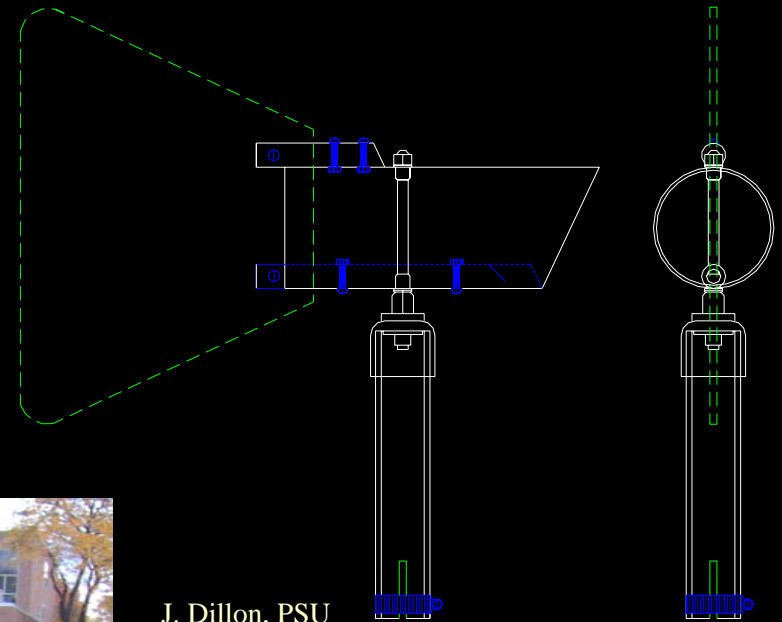
- Evaluation of spore monitoring already accomplished
- Refinement and focus on trapping methods
- Additional spore trapping
 - South America
 - Spore release from Kudzu (Florida)

Plans for Continued Work

- Finding overwinter sites and monitoring spore movement is critical



Prototype of Passive Trap for 2006



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Spore Deposition in Rain

- Trapping network in OH, PA, MD, NY and DE
- Rain trap : funnel, pvc pipe, filtering device
- Recover filter and send to central location
- Extract DNA and subject to RT-PCR



Results: Refining Methods

- Adapted extraction procedures for use with paper or membrane type filters
- Detection level ~10 live spores
- Dead spores did not produce same signal strength
- Positive and negative controls and repeated samples allow confirmation

Results of Spore Trapping

- 68 total samples collected across 5 states
- Some samples did test positive for the pathogen, but replicate sample negative
- Results of monitoring need to be compared with spore transport models

Conclusions

- Spore trapping has been used for pathogen detection and combined with prediction models to estimate disease risk for other systems
- Tremendous amount of research effort address critical issues
- Realistic expectations needed while research develops methods and establishes relationship with disease