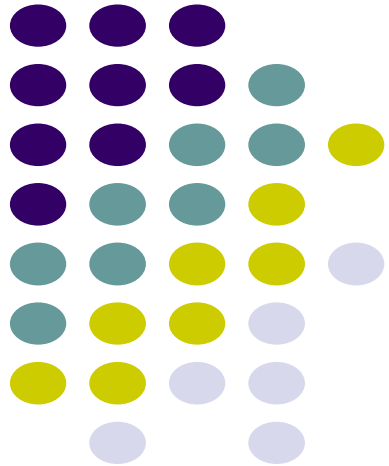
Use of Airborne Inoculum Detection for Disease Management Decisions

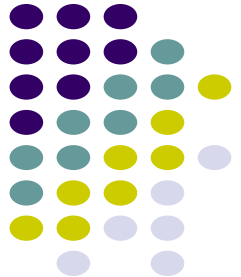


- Knowledge of inoculum presence has been used for decades to help guide disease management decisions. However, its implementation on a broad scale has been limited due to the capital costs and requirement of technical skill for effective monitoring of pathogen presence across large areas.
- Recent advances in nucleic acid detection technologies are showing promise in enabling field level implementation of inoculum detection and quantification to aid in disease management decisions.

- There have been several successes in monitoring airborne inoculum to aid in disease management systems
- For example, presence of airborne inoculum was used to initiate fungicide application to manage potato early blight caused by *Alternaria solani*.
- Similarly, the hop downy mildew disease forecaster system is used in the Hallertau region of Germany to time fungicide applications.
- This system relies on a combination of weather based disease forecasting and the visual identification and quantification of *Psuedoperonospora humuli* sporangia to guide timing of fungicide applications; thus, demonstrating that monitoring airborne inoculum can be commercially implemented

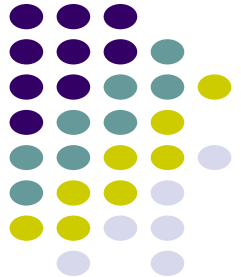
- While inoculum monitoring can be useful for aiding in disease management decision, it has always been difficult to implement on a broad scale due to the difficulty in and cost of sample collection and visual identification of infective propagules.
- To reduce the time required for assessing samples and increase confidence in inoculum identification various immunological and nucleic acid based technologies have been developed that are suitable for detecting and quantifying airborne inoculum

Epidemiological Concepts for Monitoring Airborne Inoculum



- Disease management strategies of airborne plant pathogens are based on the assumption that
  - inoculum is always present and
  - often fail to predict the severity of the epidemic because they do not account for the quantity of initial inoculum present at a location.
- There are numerous reasons for differences in initial inoculum:
  - differences in microclimate or
  - management practices that impact inoculum survival or
  - the amount formed the previous season.
- For example, with grape powdery mildew cleistothecia are considered the predominant overwintering structure and are formed in the late summer to early fall. The amount formed is considered to be a function of the disease severity as influenced by canopy density and microclimate, which result in the aggregation of overwintering inoculum.

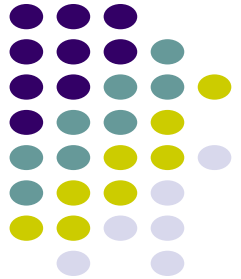
Methods for Monitoring Airborne Pathogen Inoculum



- The practical assessment of air borne inoculum presence requires a means of collecting airborne propagules that is both easily processed and inexpensive. There are two main approaches to sampling airborne inoculum: passive sampling and volumetric sampling.
- Passive sampling relies on either gravitational forces to cause settling of airborne propagules to horizontal surfaces (e.g. coated glass slides, agar plates) in the area of interests or inertia to imping particles onto a vertical surface. Although quite cheap and easy to implement, the highly variable sample volume associated with passive sampling strategies limits their utility in monitoring for pathogen presence. This approach also tends to utilize a large sampling surface which can be advantageous for visual detection but poses problems for other detection methods.

- Volumetric samplers utilize three main approaches (inertia, filtration, or cyclonic/centrifugal separation) to collect propagules by moving either known volumes of air over the sampling surface or by moving the sampling surface at a known rate through the air to cause impaction of airborne propagules onto or in sampling matrices; thus, achieving a standard air sample volume. Electrostatic charge has also been used to collect airborne propagules onto a sampling matrix.

Methods for Pathogen Identifications



- Immunological Testing
- Nucleic Acid Testing
- Isothermal Amplification