

Epidemiology Lab

Late Blight of Potato

Responsible for Irish Potato Famine in 1840s
important in the development of plant pathology and the germ theory of disease
Still the most important potato disease worldwide
Caused by *Phytophthora infestans*
- a Stramenopile
- disease favored by cool, wet conditions

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Late Blight of Potato

Disease development requires 10-12 hours of leaf wetness at 15-25°C
Each lesion can produce 100,000 to 300,000 sporangia per day
Sporangia can be aerielly dispersed
Typical polycyclic pathogen with potential for explosive increase in disease

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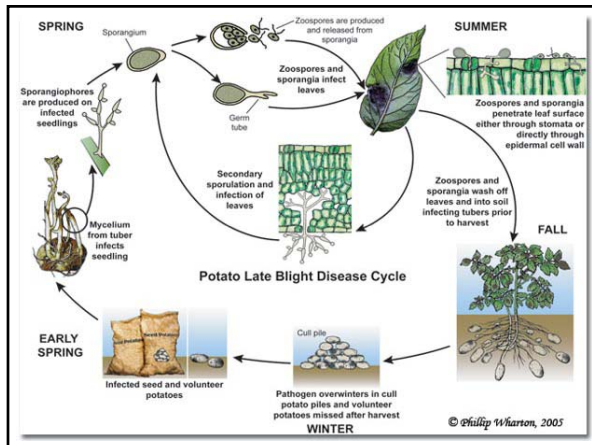


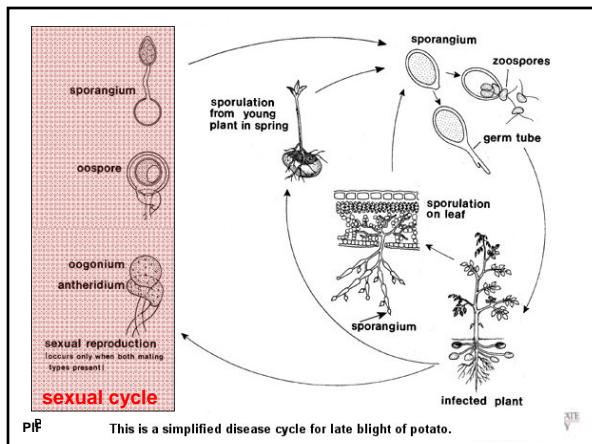
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PI#

This is a simplified disease cycle for late blight of potato.

Phytophthora infestans

Branched, indeterminate sporangiophores
Lemon-shaped sporangia
Sporangia germinate indirectly (<15°C [12°]) or directly (>15°C [24°C])
Motile zoospores
Heterothallic - two mating types - produce oospores
Limited saprophytic ability - requires living host to survive if no oospores present

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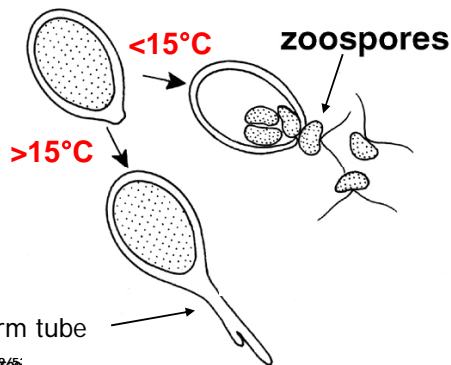
Sporangia, sporangiophores and zoospores of *Phytophthora infestans*



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W.E. Fry, Cornell Univ. STATE UNIVERSITY

sporangium



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Direct germination of sporangia optimum = 24°C



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Late Blight Management

- Resistant cultivars
 - often limited due to specific market requirements of potatoes
- Foliar fungicides
- Destruction of potato cull piles
- Destruction of volunteer potato plants
- Vine killing with herbicides to limit tuber infection

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Late Blight Management with Fungicides

- Fungicides applied on calendar schedule (generally every 5-7 days) under high disease pressure
- Protectant and systemic fungicides are used
- Protectants need to be on plant surface **prior** to arrival of pathogen
- Systemics may have limited post-infection activity - generally a few days - can "cure" and infection
- Systemics are usually more expensive

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Late Blight Management with Fungicides

Fungicide weathering - window of effectiveness for a specific fungicide - depends on rainfall, temperature etc.
Can fungicide use be limited to times only when needed?
Need to be able to predict disease development

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Late Blight Management with Fungicides

Can we predict the onset of disease and disease development based on our knowledge of pathogen biology, growth of host, and environmental requirements for disease (i.e. disease triangle)?

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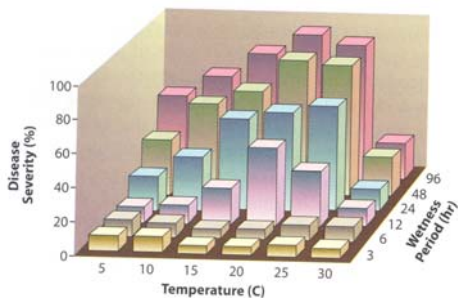
Disease Simulation

A method to recreate a disease epidemic
Allows us to evaluate each component of the disease triangle
- **pathogen and host are not independent**
A way to describe the disease process with mathematical equations
Disease process is broken up into manageable sub-units such as infection, lesion expansion, sporulation etc.

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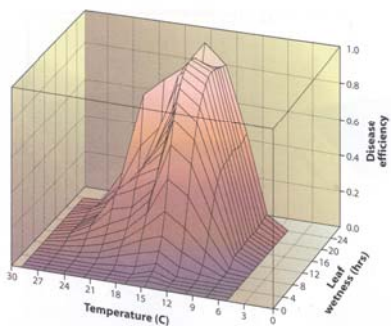


Interdependence of Temperature and Leaf Wetness on Disease Development



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Model for Effect of Temperature and Leaf Wetness on Disease Development



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Disease Forecasting

Two types:

Predict infection periods for a specific pathogen

Predict disease development

Most are **empirical** prediction systems - developed using historical weather and disease data

BLITECAST - late blight prediction system

developed by Krause (1975)

- "Severity values" assigned to specific relationships between relative humidity and temperature

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BLITECAST (Krause 1975)

Late blight is forecast to occur 7-14 days after the accumulation of 18 severity units - **"action threshold"**

BLITECAST module is part of the LATEBLIGHT disease simulator you will use in lab

Try using this module so see if you can improve your disease management decisions

You can simulate disease development under a calendar fungicide spray schedule and compare that to under a spray schedule predicted by BLITECAST

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BLITECAST

Ave. Temp.	Number of hours when relative humidity is greater than or equal to 90%				
45-53 °F	15	16-18	19-21	22-24	25+
54-59 °F	12	13-15	16-18	19-21	22+
60-80 °F	9	10-12	13-15	16-18	19+
Calculated Severity Value	0	1	2	3	4

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