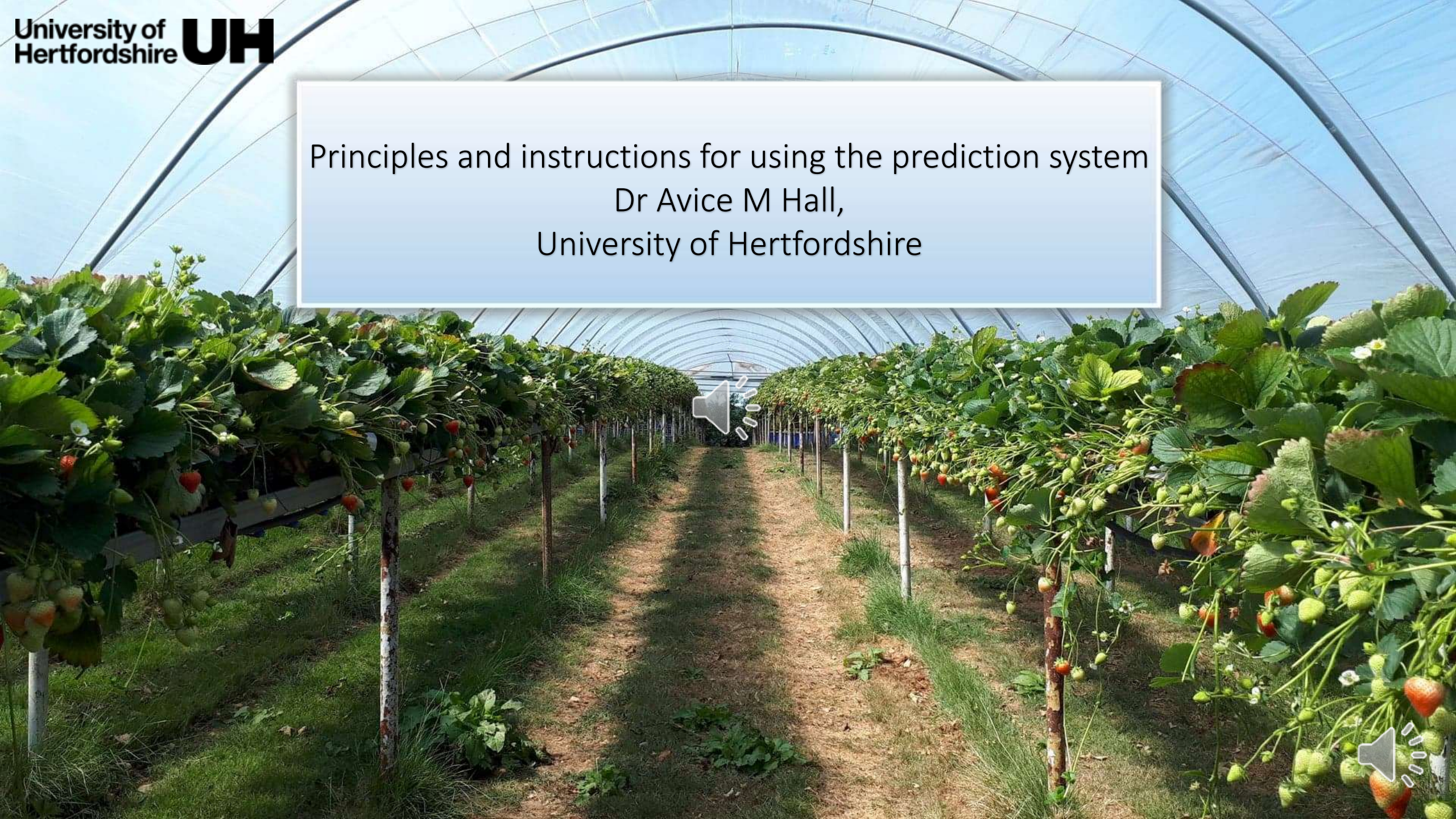


Principles and instructions for using the prediction system

Dr Avice M Hall,
University of Hertfordshire

What is the prediction system?

A **decision support system** (DSS) designed to support the grower for the intelligent use of fungicides, spraying only when conditions are favourable for disease development.

The prediction system accumulates the number of hours needed for the fungus to grow from spores to producing the next generation of spores.

Key characteristics:

- Decision support system;
- Predict when to spray to keep initial inoculum as low as possible;
- Control the disease with fewer fungicide applications;
- Simple, easy to use, user friendly, reliable;
- **NOT** forecasting disease levels

Agri-tech SERVICES

University of Hertfordshire UH

How does the disease enter the crop?

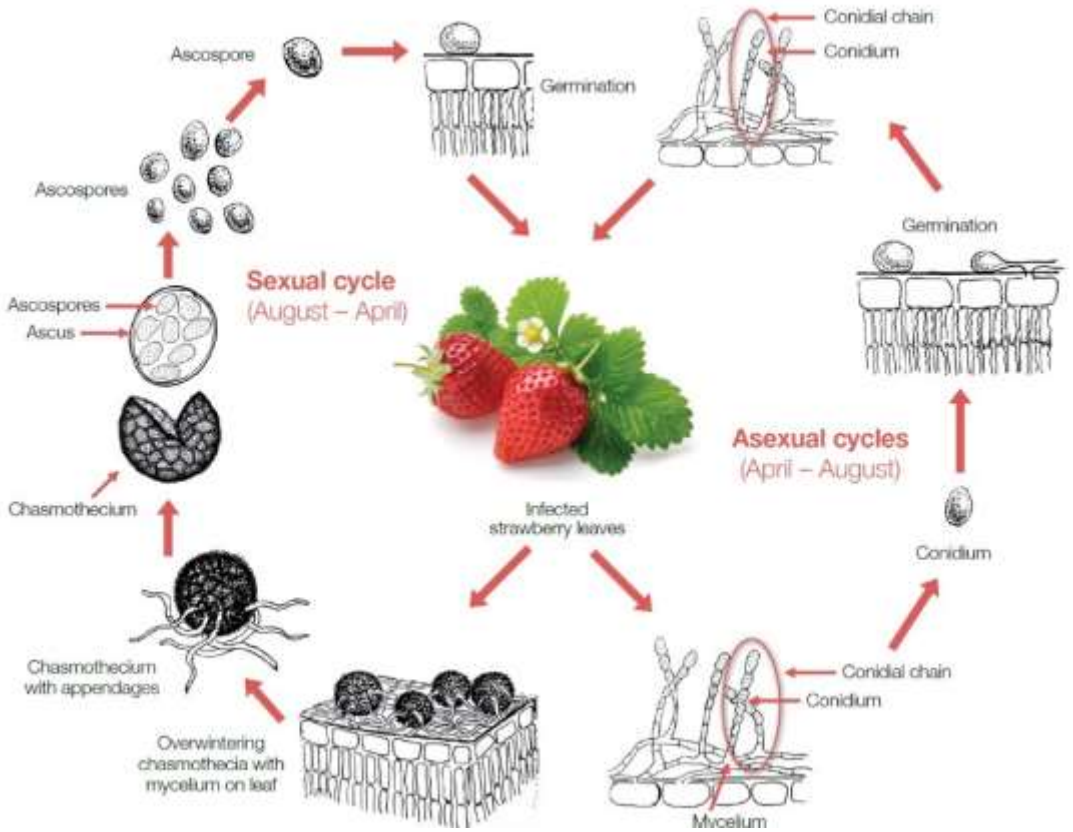


Figure 1 Lifecycle of *P. aphanis* (Xiaolei Jin, 2016)

- *Podospheara aphanis,* the fungus that causes strawberry powdery mildew can only grow on strawberry plants and fruit.
- Where the crop is overwintered the disease can overwinter as the chasmothecia and then ascospores released in the spring initiate infection (Fig. 1) (the use of fleece may bring this date forward);
- Where it is an annual crop, the powdery mildew often comes in at low levels on plants from the propagator;
- Conditions in the tunnels frequently encourage the fungus to grow;
- Conodiospores spread within tunnels and cause the main epidemic and potentially spread between continuous tunnels; May spread from infected susceptible cultivars to other near by cultivars.

Agri-tech SERVICES

University of Hertfordshire UH

Disease epidemic build up

The development of disease epidemic contains three phases (Fig. 2):

a. Lag Phase

Spore germination, and fungus growth to spore production. Not enough disease development to be detected by naked eye, though early symptoms (cupping) may be visible. Length of lag phase governed by the number of disease conducive hours (Fig. 3);

b. **Log Phase**

Fungus grows and spreads exponentially (i.e. doubles in each time period) at a speed governed by the number of disease conducive hours; the quicker the disease conducive hours accumulate the faster the fungus grows, and the steeper the line of the exponential phase;

c. **Stationary Phase**

No healthy tissue left to be infected.

The Aim of the prediction system is to keep the disease in the lag phase, thus reduction the inoculum level throughout the season

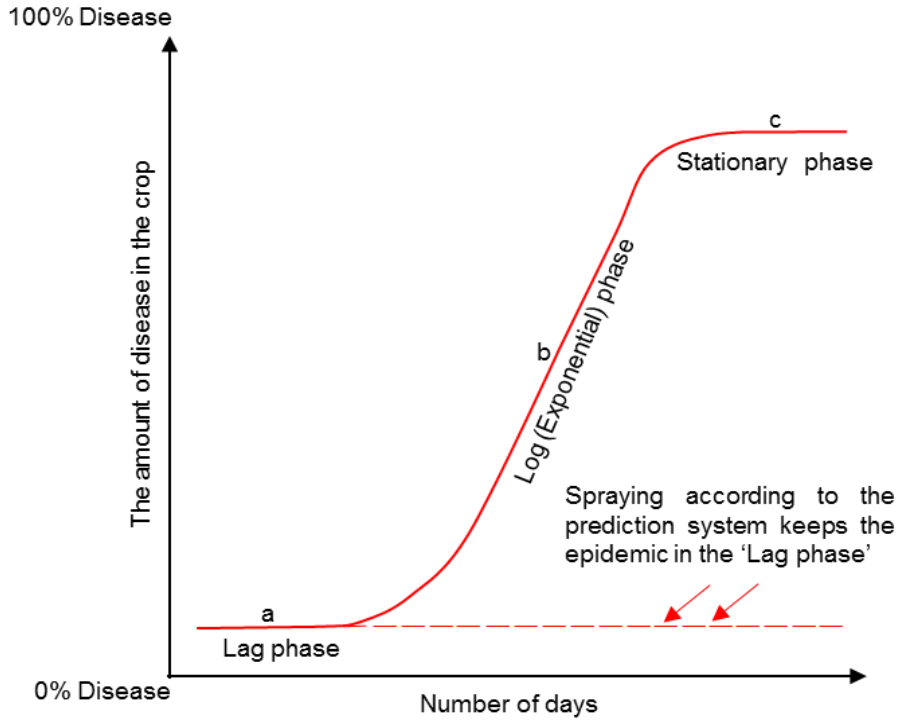
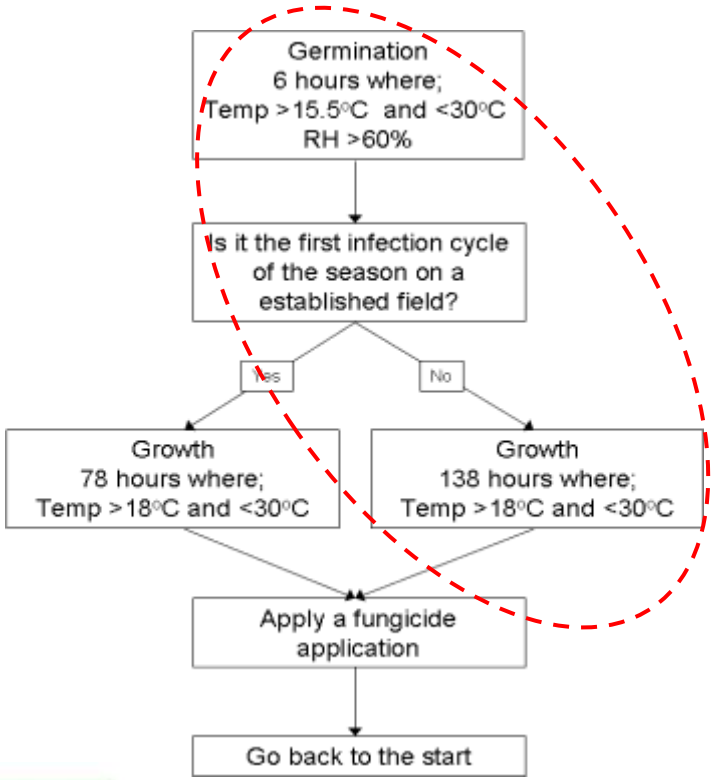


Figure 2 a typical epidemic curve, and also shows how disease levels can be kept to a minimum if spraying using the prediction system.

Disease conducive hours

The number of hours of correct environmental conditions for a particular fungus to grow.

For *Podosphaera aphanis* (Strawberry powdery mildew) the conditions are temperature >15.5°C and <30°C (15.5°C is the minimum temperature for spore germination, whereas 18°C is the minimum temperature for sporulation), with relative humidity (RH) >60%.



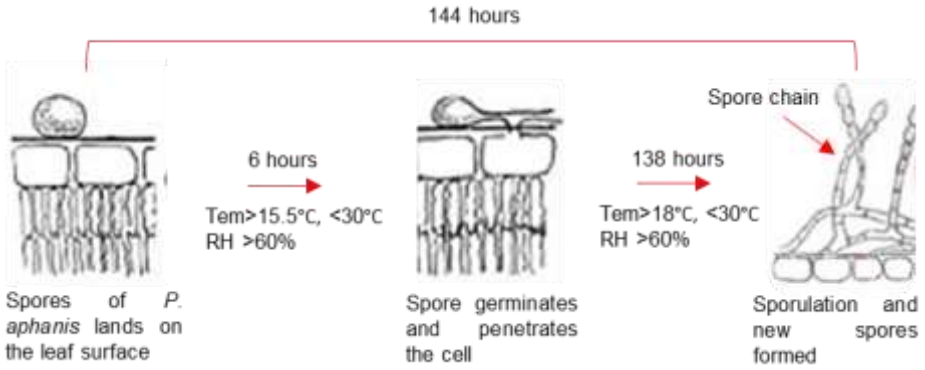


Figure 3 Asexual life cycle of *P. aphanis,* showing the number of disease conducive hours needed for each cycle of spore production (Xiaolei Jin, 2016)

What does the prediction graph tell the grower

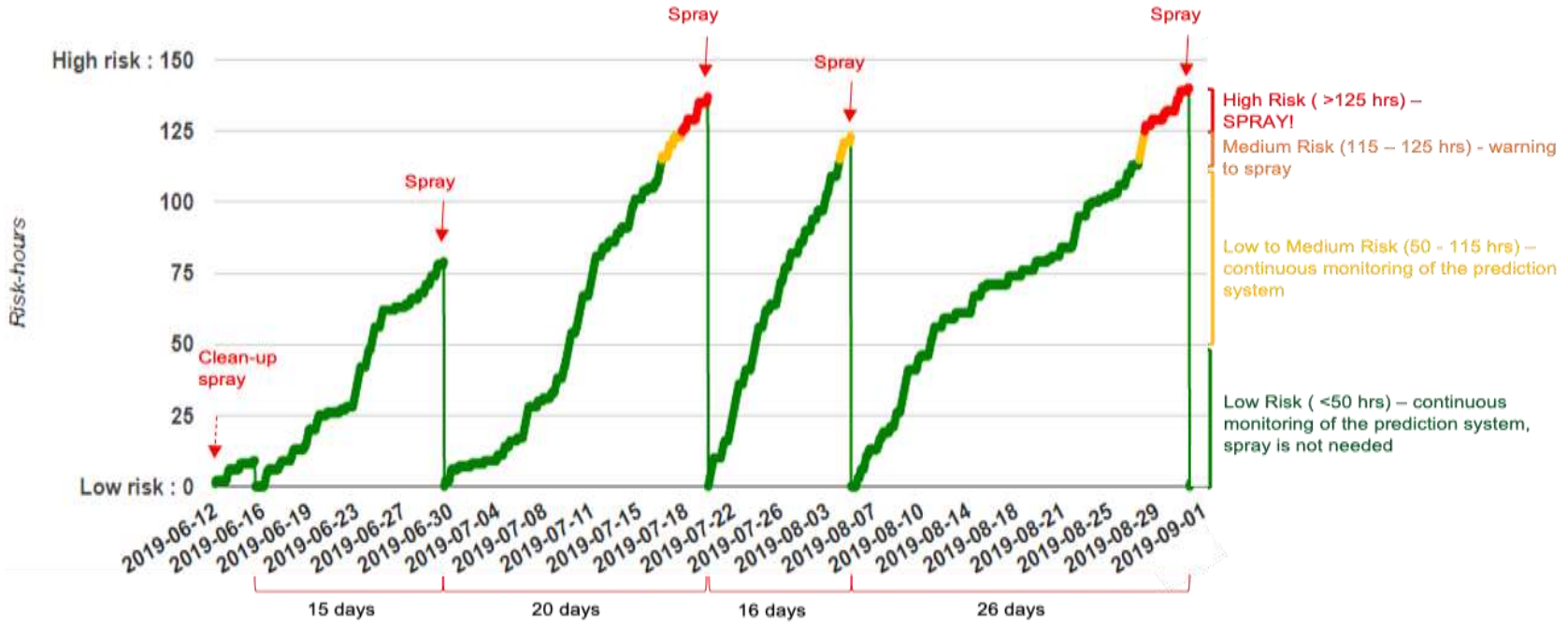


Figure 4 A prediction graph as shown from the online platform

- The Y-axis of the prediction graph indicates the number of accumulated hours where both parameters are met;
- The X-axis showing the date;
- When the ascending green line turns to amber (at 115 hours), this is a warning for the grower to prepare to spray;
- When the line turns to red (at 125 hours), a fungicide spray is needed;
- At **144** hours, the fungus can start to reproduce and produce spores, i.e. initiate an epidemic if the grower has NOT sprayed;
- After spraying, grower enters fungicide details and resets the system, which then starts to accumulate disease conducive hours.

Points to be noted

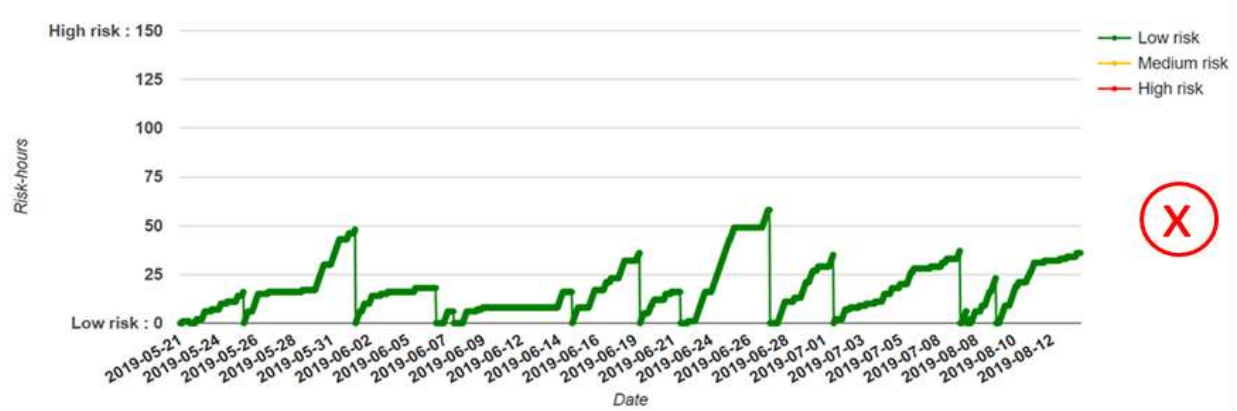
- At the start of the season, always assume that there may be some disease (overwintered or from propagator), do a **clean up spray**;
- **Low Risk**: <50 hours, the fungus will not have grown very much;

  High Risk: >125 hours, the fungus is likely to reproduce and produce spores, fungicide sprays are needed;

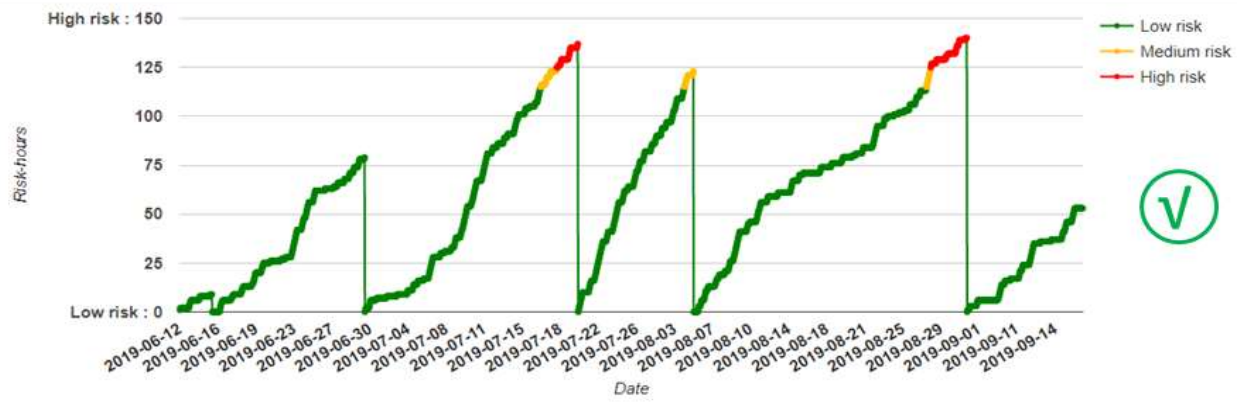
  Continuous monitoring of the prediction system is required even when the risk level is low;
- If there is a constant accumulation (e.g. 24 hours of disease conducive conditions per day), **144** hours will be quickly reached, the grower would need to spray every 6 days; however, this is unlikely;

  If there is only 6 hours of disease conducive conditions per day, the grower would only need to spray every **24 days**;
- The system is recording disease conducive hours, **NOT** forecasting disease levels;
- The grower makes the decision as to what fungicides to use, using Mode of Actions (MoA) in rotation and biological controls if appropriate;
- Finally, **Spray with precision** without panicking. Weekly spray (Fig.5-a) is not needed if you follow the prediction system accordingly (Fig.5-b).

Examples of two sites using the prediction system



(a) Weekly spraying, not following the prediction system



(b) Spraying according to the prediction system

Figure 5 Examples of two sites using the prediction system

How to use the system

1. Preform a **clean up spray** at start of season to reduce initial inoculum;

2. Frequently (daily) monitor the accumulation of hours of disease conducive conditions on the graph;

3. When the line reaches amber (115 hours), WARNING: potential high risk of disease, prepare to spray;

4. When the line reaches red (125 hours), imminent risk of disease spread, SPRAY!

5. Enter the name and rate of each fungicide used against strawberry powdery mildew; as soon as it has been sprayed, **reset the system to 0**;

6. It may be useful to keep a note of why you made this decision to spray. (eg for Strawberry powdery mildew or Boytrytis)

Agri-tech SERVICES

University of Hertfordshire UH