Experiences with Smith Periods, SCHRÖDER and ULLRICH Negative Prognosis, FREY Phytophtora Units Model calculated on a µMETOS electronic climate station

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Summery: Potatoes are commercially grown in areas with widely differing climate. From a 120 day growing season in Scandinavia and Russia to subtropical areas in Asia and South America. No single *Phytophtora infestans* Infection or Risk Model based on climate data will fit to all these locations. µMETOS is a small and economic electronic climate station with built in plant disease Models which is world-wide sold by Pessl Instruments GmbH. Our target is to equip µMETOS with disease models for *P. infestans* fitting into most of the potato growing environments.

We found "Smith Periods" to be the *P. infestans* disease model fitting best to the climate of Great Britain and Ireland. Due to the fact that this model only needs data on temperature and relative humidity µMETOS offers a cost effective solution for use of *P. infestans* disease model in IPM in this environment.

The combination of SCHRÖDER and ULLRICH Negative Prognosis and the accumulated FREY Phytophtora Units Model predicts the time of the first application needed and the spray interval for ongoing disease control. This fits well in potato production areas with moderate climate.

The single use of accumulated Fry Phytophtora units fits into the potato production in irrigated southern mediterranean environments where potato is grown all year round. Problems with every disease model which we have been testing so far where in there climates in combination with centre pivot irrigation systems. The long wetting period in the inner areas of the centre pivot forms a micro climate favouring *P. infestans*.

Potato Late Blight *Phytophtora infestans* Smith Periods Model Describtion

Definition: Two consecutive days with minimum temperature of 10 °C and 10 hours of relative humidity higher than 90% on the first day and 11 hours of relative humidity higher than 90% on the second day is a **Smith Period**.
If the criteria for the fist day is fulfilled and the second day reaches 10 hours of relative humidity higher than 90% this indicates that 90% of the Smith period or **Near Smith**.

Biological Basis: *Phytophtora infestans* can grow if temperature is lower than 10°C. But sporulation will be nearly nothing at this temperatures. Therefore it needs a moist period with temperatures higher than 10°C to get a reasonable sporulation. Infection of *Phytophtora infestans* needs free moisture. In longer periods of high relative humidity free moisture either by rain or by dew is very much probable.

Result: Smith periods or near Smith periods are pointing out periods where the climate is very favourable for the disease. The model points out periods with a very high risk of this disease.

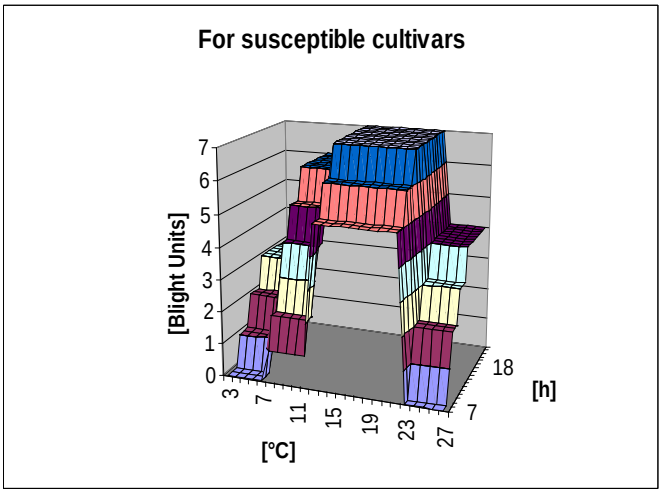
Potato Late Blight *Phytophtora infestans* SCHRÖDTER and ULLRICH Negative Prognosis Model Describtion

This model uses measurements of temperature, relative humidity, and rainfall to predict when late blight (*Phytophthora infestans*) epidemics are not likely to occur. It has been used in Germany to predict the timing of the first treatment. Daily and accumulated risk values over a week are calculated starting at crop emergence. Negative Prognosis cannot be used in areas with permanent cropping of potatoes, areas with no winter.

Functionality: First the negative prognosis value increases with time. Duration of moist periods and temperatures favouring pathogen development are fastening the increase of the Negative

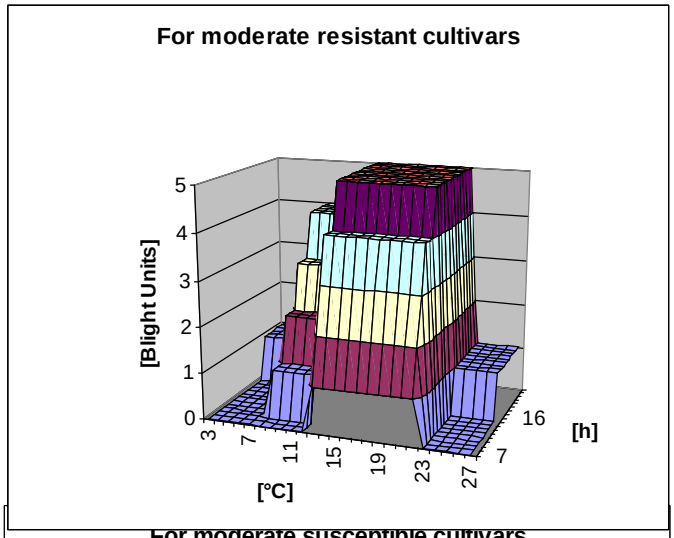
Prognosis Value. A moist period is defined as hours with more than 90% relative humidity, leaf wetness or more than 0.1 mm of rain. The model differentiates between moist periods with 4 h duration and with 10 h duration.

Thresholds: The model gives two thresholds: A value of 150 indicates the date when we can suspect a disease incidence of 0.1% in a year with average to high inoculum pressure. A value of 270 indicates the date when we can suspect a disease incidence of 1% in a year with average to high inoculum pressure. In year with average inoculum pressure 150 would be the value to start to spray. In a year with low inoculum pressure 270 would be the value we start to spray. Inoculum pressure is influenced by the last year disease occurrence in the seed producing area.



Potato Late Blight *Phytophtora infestans* Fry Blight Units Model Describtion

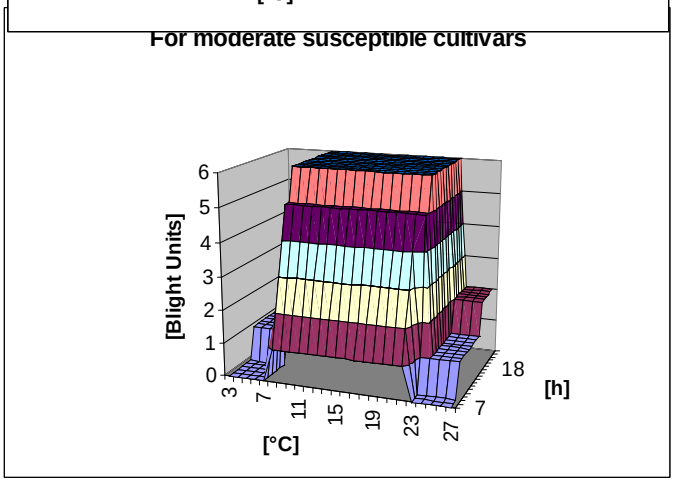
The Infection Model uses relative humidity higher than 90% or Leaf wetness to estimate moist periods. Depending on the duration of moist periods and the temperature during this period Blight Units for susceptible, moderate susceptible and moderate resistant cultivars are estimated following the graphs below.



Potato Late Blight *Phytophtora infestans* Fry Blight Units, The Spray Interval Estimation Model Model Describtion

... uses the result of the daily calculations from the infection model described at the slide before. With different thresholds for susceptible, moderate susceptible and moderate resistant cultivars the model helps to decide if a spray is needed or not.

A spray is indicated if:
the last spray is longer than 6 days away
and
the accumulated blight Units are exceeding:
30 for susceptible varieties
35 for moderate susceptible varieties
40 for moderate resistant varieties

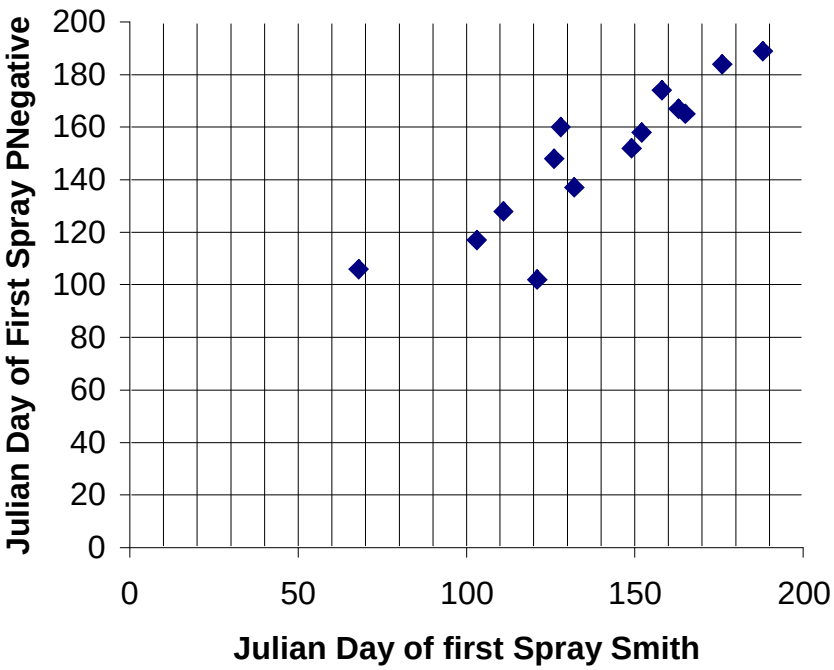


Applying this model in cool climate potato production it is suggested to combine it with the SCHRÖDTER and ULLRICH Negative Prognosis. The first Spray is applied at the time the Negative Prognosis indicates it. Further sprays are applied following the rules mentioned above.

Methods in this work: The notebook used to support clients through all of Europe using the µMETOS weather station gives a random collection of climate data from potato growing areas. This 3 models have been calculated on this data and the results are summarised in the following chapters.

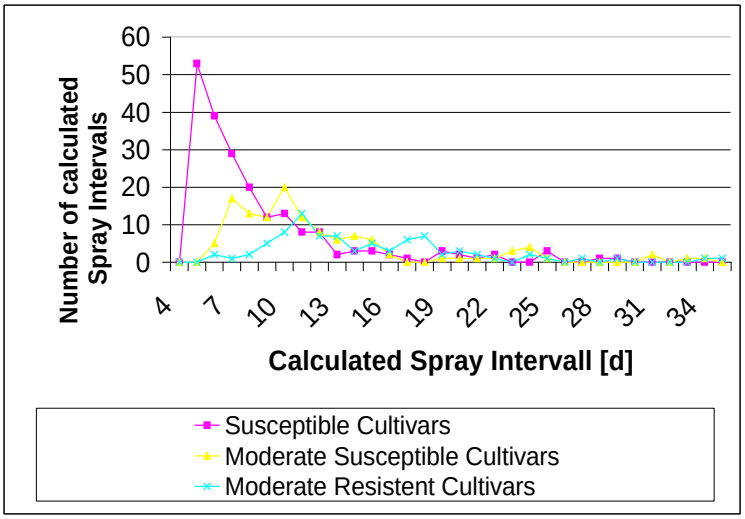
Prediction of the first spray against *P.infestans* with Smith Periods and SCHRÖDTER and ULLRICH Negative Prognosis

On 14 randomly chosen climate data sets from different locations in Europe Smith Periods and SCHRÖDTER and ULLRICH Negative Prognosis are predicting the first spray 6 times within the same week. 7 times Smith Periods are predicting the first spray more than 7 days earlier than SCHRÖDTER and ULLRICH Negative Prognosis. Only 1 time SCHRÖDTER and ULLRICH Negative Prognosis was predicting the first spray earlier than Smith periods. In locations where warm spring days can be followed by cool climate Smith Periods will predict much too early.



Applying the FRY Model to calculate the spray interval on a set of random chosen climate data files from all over Europe shows:

- Among 206 calculated spray intervals for susceptible cultivars 85 are longer than 1 week but only 19 are longer than 14 days.
- Among 124 calculated spray intervals for moderate susceptible cultivars 102 are longer than 1 week and 24 are longer than 14 days.
- Among 84 calculated spray intervals for moderate resistant cultivars 84 are longer than 1 week and 36 are longer than 14 days.



Growing susceptible varieties the use of this model will save sprays only in dry years or in dry areas. On moderate susceptible or moderate resistant varieties the use of the model will save sprays compared with a calendar spray schedule.

Literature:

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