O.25 - Identification of 'best parts' of existing DSSs for crop protection for unification on an European level: late blight in potato

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Abstract

In the majority of European countries with high potato production there has been conducted a very intensive chemical protection of potato crops against potato late blight. In recent years, up to twenty applications were used to control the disease in some parts of Europe. A number (about 15) of decision support systems for the chemical control of potato l.b. are now in operational use in Europe. The changes in population of *P. infestans* is a threat for late blight control in general, but also for the use of existing warning and forecasting systems, because most models are based on data collected before the new population was established. The importance and role of different inoculum sources for first outbreak is not yet well estimated and DDS models need to be improved in this area. To construct a good DSS for *P.i.*, a set of "construction elements" was identified: biology of pathogen (characteristics of population, qualification of primary inoculum sources), outside elements (variety resistance, weather conditions), protection management (agrotechnology, monitoring of early infestation, forecasting systems, performance of fungicides). The goal of the survey of existing European decision support systems for l.b. control was the identification of their "best parts" and adopting them for construction of future DSS. Some elements of the existing DSSs were identified as valuable and just ready for future systems (monitoring of the first early l.b. attacks, variety and fungicide databases, pathogen population characteristics).

Late blight is still the greatest potential disease threat to potato crops, accounting for significant annual losses world-wide. The disease occurs commonly in most potato-growing areas, depending on the presence of the pathogen and cool, wet weather conditions. Sources of *Phytophthora infestans* inoculum are seed tubers, dumps, volunteers, closely related weed hosts and adjacent plants of potatoes or tomatoes that are affected. Spores released from infected plants are known to be capable of wind-borne migration over several kilometers. No other disease demands such collective responsibility to safeguard potato production. Late blight is controlled by eliminating sources of inoculum, applying fungicides during growing season and using proper harvesting and storage practices.

Fungicides are most effective in the early stages of an epidemic before symptoms can be seen. None of them can totally cure an infection and they have little effect when blight is established. Programme of fungicide sprays should commence long before late blight appears in the potato field. One of the reasons for blight becoming established in a crop is the failure to begin the programme early enough. Normally, the spray applications start just before the crop plants meet along the row, before the haulm is capable of providing the microclimate which encourages disease development. Many efforts have been made to forecast blight or provide systems that support the spray decision and replace routine, prophylactic spraying. All forecasts are based on determining the probability of weather that will favour appearance and development of the disease and assume existence of a primary source of infection in the region. The actual level of inoculum present at the time is unknown so none can take it into consideration.

In the majority of European countries with high potato production very intensive chemical protection of potato crops is conducted against potato late blight. In recent years, up to twenty applications were used to control the disease in some parts of Europe (Schepers & Spitz 2006, Hensen *et al* 2007). At the same time political action plans demand a minimalized use of pesticides. Decision support

systems (DSSs) used in control of potato late blight in potato crop protection help to determine an accurate date of first treatment and the following applications. This allows the number of fungicide treatments to be decreased and plays a significant role in both the cost-effectiveness of chemical protection and also in environment protection.

A number of decision support systems for the chemical control of potato late blight are now in operational use in Europe: Blight management (DK), VIPS /Førsund (N), MilDiLis (F), Guntz-Divoux/MILSOL (F, B), Phytopre (SCH), Simphyt/Simblight, ProPlant (D), PlantPlus, ProPhy (NL), Blight Watch /FAB (UK), IPI (I), NegFry (PL, EE). Each of models has their advantages and 'defects'.

During recent years new *Phytophthora infestans* populations have been established in Europe. There are indications that the sexual recombination by *P. infestans* has caused a change in the behaviour of the pathogen (Fry et al., 1993; Drenth 1994; Duvauchelle, Lherbier 1996). Observations include more aggressive genotypes and earlier stem blight infections from soil (probably from seeds or oospores). The changes in epidemiological development of *P. infestans* is a threat for late blight control in general, but also for the use of existing warning and forecasting systems, because most of the models are based on data collected before the new population was established (Hansen et al., 2001). The importance and role of different inoculum sources for first outbreak is not yet well estimated and DDS models need to be improved in this area.

To construct a good DSS for *P. infestans* control, a set of 'construction elements' was identified:

1. Model of *P.infestans* development based on meteorological factors – epidemical model on *P.i.*
2. Weather data (elements influenced on rate of late blight development and the disease epidemic)
3. Pathogen
   a/ biological elements of the pathogen
   b/ characteristics of pathogen population, connected with pathogen changes
   c/ qualification of primary inoculum sources importance and their role in epidemics
4. Plant host
   a/ resistance of potato varieties for late blight (resistance of leaves, stem, tubers)
5. Late blight management - influence of management elements on good control effectiveness
   a/ agrotechnology (type of soils, fertilisation, etc.)
   b/ performance fungicide (characteristics of effectiveness)
   c/ monitoring of early infestations
   d/ forecasting system
6. Distribution of DSS (ways of distribution to end users)

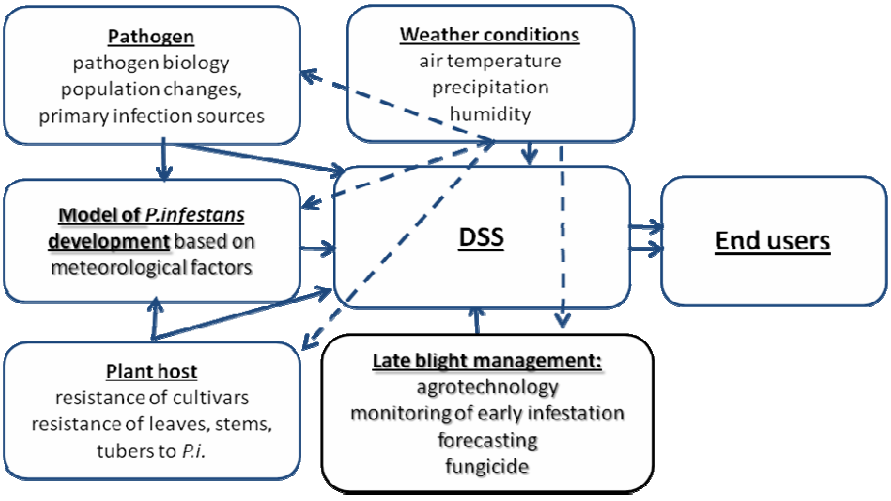

Fig.1. Important elements for DSS construction

7. Economic problems to solve (cost of weather data, subscription for users)
8. Elements not yet identified?

The goal of the survey of existing Europe decision support systems for control of late blight was identification of their 'best parts' and adopting them for construction of future DSS. During the survey some elements of the DSSs were identified as valuable and just ready for future systems. They are the result of collaborative cooperation of many people from many countries.

Monitoring of the first early l.b. attacks (Fight against Blight / WEB-BLIGHT / ISIP). To use the Web-blight network, each country is responsible for organising a local network The late blight monitoring system makes it possible to evaluate reliability of the forecast provided by decision support systems that are applied in potato protection and in consequences defends in practice potato crops from earlier appearing infections (Hansen et al., 2003).

Variety database. Variety database includes potato variety information collated and generated by Eucablight (Potato Late Blight Network for Europe). Thanks to the link from specific variety names it is possible to find additional information taken from the Europotato database (www.eucablight.org).

Pathogen population information Characterising pathogen population variation from Eucablight. The collation of molecular marker data, information on aggressiveness and virulence, mating type and fungicide resistance allow the mechanisms and tempo of genetic change within populations of *Phytophthora infestans*. populations across Europe (www.eucablight.org) to be determined.

Fungicide database provides information about performance of fungicides, including: rainfastness, UV-degredation, etc. from EuroBlight. The effectiveness of fungicide products/co-formulations for the control of *P. infestans* based on the highest rate registered in Europe. These ratings are the opinion of the Fungicides Sub-Group (independent scientists and representatives from the crop protection industry) and are based on field experiments and experience of product performance when used in commercial conditions (www.Euroblight.net).

Chemical protection can comprise the intensive usage of fungicides starting from potato emergence or as sustainable protection based on forecasting of pathogen occurrence and utilising decision support systems that could help to predict the date of disease outbreak and to determine the timing of first treatment and the most suitable intervals between sprays.

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