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Towards future-proof crop protection in Europe

Sustainable control of late blight in potatoes

H. Schepers, B. Evenhuis & M. van Zeeland

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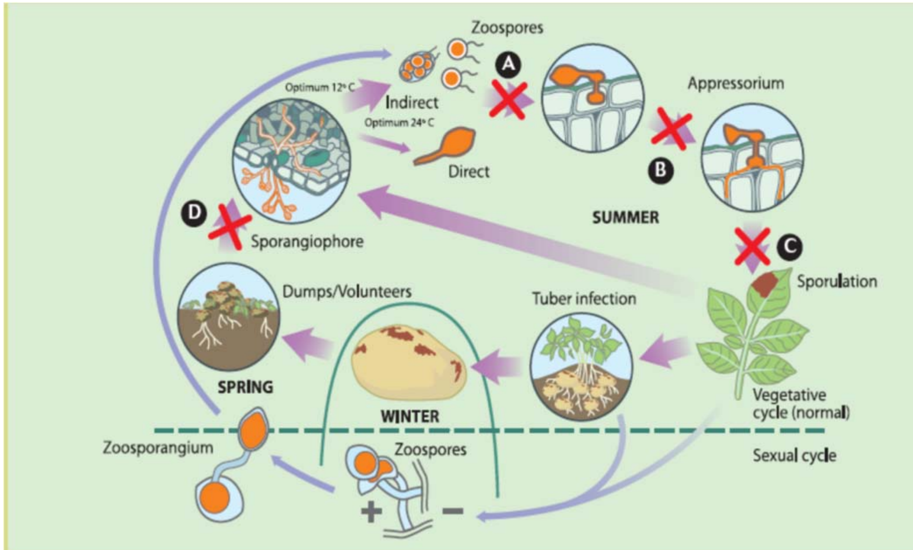
EFPP
European Foundation for Plant Pathology

Late Blight

- Worldwide 21 million ha and € 10 billion damage
- In NL 165.000 ha with average 45 ton/ha yield
  - turnover € 750 million year
- 12-15 sprays/year
- Costs per year
  - Fungicides € 50 million
  - Spraying € 50 million
  - Damage: € 20 million
  - Total € 120 million (=15% of the turnover)



Umbrella Plan Phytophthora

Consortium formation in 2003:

- Wageningen University Research
  - Applied Plant Research
  - Plant Research International
  - Univ. Dept. Sciences
- Agribusiness (breeders, growers, trade, intermediates)
- Ministry of Agriculture

Aim: <u>75% reduction</u> of negative impact of pesticides in 10 years

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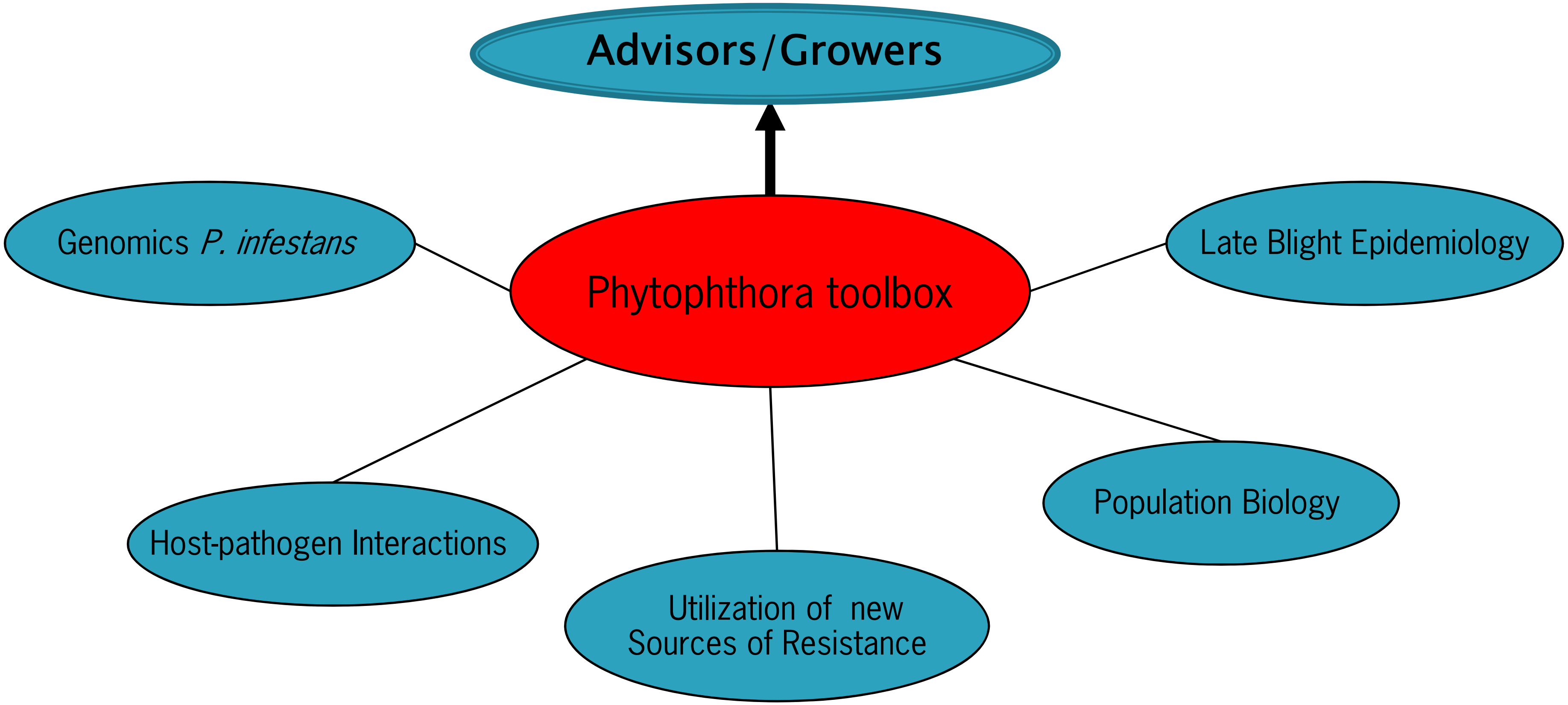
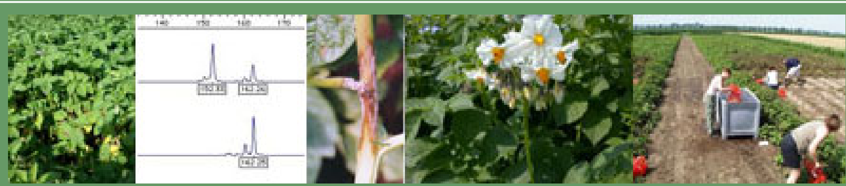
Themes Umbrellaplan



EuroBlight

A potato late blight network for Europe



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- DSS systems overview
- Sub-models description
- Compare submodels
- Best Practice
- Weather data

Case - Denmark

Case A: In Denmark farmers have been using reduced dosages for years.

In Denmark, data from the national monitoring network, weather based infection pressure, cultivar resistance and crop growth stage determine strategies with reduced dosages.

Dose Model   Results 2009

Cases - the Netherlands

Case A: Test of strategies with reduced dose rates.

: of a DSS to

ules on

...ents of an Integrated Control strategy for late blight in Europe are presented and ...xpert judgement) for implementation, barriers and contribution to input reduction are

	...mentation	Barriers	Contribution to input reduction	Organic
Crop Rotation	Only on best farms/in some regions/in some countries	Economic/costs AND limited influence on blight	Intermediate	Applicable in organic farming
Primary inoculum sources	Only on best farms/in some regions/in some countries	Economic/costs AND risk perception	Intermediate	Applicable in organic farming
Planting time and density	Only on best farms/in some regions/in some countries	Economic/costs AND limited influence on blight	Small	Applicable in organic farming
Fertilization	Only on best farms/in some regions/in some countries	Limited influence on blight	Small	Applicable in organic farming
Irrigation	Widespread in practice	Limited influence on blight	Small	Applicable in organic farming
Cultivar resistance	Only on best farms/in some regions/in some countries	Economic/costs AND risks AND risk perception	Lower dependency on chemicals AND Large	Applicable in organic farming
Fungicides	Widespread in practice	Economic/costs AND risk perception	Intermediate	Not applicable in organic farming, except that some countries allow use of Copper
DSS	Only on best farms/in some regions/in some countries	Economic/costs AND risk perception	Intermediate	Applicable in organic farming, excluding fungicide modules etc.
Desiccation	Widespread in practice	Risk perception	Small	
Harvest	Widespread in practice	Economic/costs		

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Reduce primary inoculum sources

From Science to Field
Potato Case Study – Guide Number 1

Reducing Primary Inoculum Sources of Late Blight

Summary

The first step in an integrated control strategy for late blight is reducing the primary sources of inoculum. This Guide identifies the most common sources and ways to reduce the risk.

In a number of European countries it has been shown that in most years late blight epidemics start from infected plants on dumps and in the Netherlands, for example, a regulation forces growers to cover dumps with black plastic before April 15 each year.

Infested seed tubers are another major inoculum source and certified seed should be used where possible. Testing for latent infections in seed tubers remains problematic and this Guide provides advice on strategies for tackling this.

Oospores are another threat, especially when short crop rotations are employed, and volunteer potatoes, which are readily found in European countries with mild winters, must be controlled, even though this may be difficult and labour-intensive. Indeed, there were strong indications that in 2007 infected volunteers acted as primary infection sources rather than serving to accelerate the late blight epidemic.

Early crops covered with perforated polythene also pose a threat and this Guide recommends spraying fungicides (plus adjuvants) over covered crops to provide a level of protection for potato leaves combined with measures such as warning neighbouring growers when covers are to be removed and immediate spraying after cover removal.

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About ENDURE

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> Building a lasting crop protection research community
> Providing end-users with a broader range of short-term solutions
> Developing a holistic approach to sustainable pest management
> Taking stock of and informing plant protection policy changes.

Eighteen organisations in 10 European countries are committed to ENDURE for four years (2007-2010), with financial support from the European Commission's Sixth Framework Programme, priority 5: Food Quality and Security.

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From Science to Field
Potato Case Study – Guide Number 1

Reducing Primary Inoculum Sources of Late Blight

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Reduce primary sources of inoculum

- Regulation of Arable Board
- Inspected by NAK-Agro
  - Dumps: cover with black plastic before 15 April
  - Volunteers: control after 1 Juli when > 2 plants/m^2 per 0,3 ha
  - Excessive blight: control when:
    - > 1000 diseased leaflets/20 m^2
- Warning: yellow card
- Red card: money fine

Use resistant varieties

From Science to Field
Potato Case Study – Guide Number 4

Using Cultivar Resistance to Reduce Inputs Against Late Blight

Summary

The late blight resistance of a cultivar offers significant potential in reducing fungicide inputs as part of an integrated control strategy. Both partial resistance (lower susceptibility) and fungicides can slow the development of late blight and many reports show that partial resistance in the foliage can be used to complement fungicide applications, cutting fungicide use through reduced application rates or extended intervals between sprays.

The use of resistant cultivars varies across Europe. In Western Europe, resistant cultivars are not grown on a large scale because commercially important characteristics such as quality, yield and earliness are usually not combined with late blight resistance in the same cultivar. However, in countries where fungicides are not available or very expensive, the use of resistant cultivars is one of the most important ways to reduce blight damage.

Breeders are constantly trying to produce cultivars that combine commercially important characteristics with late blight resistance, either by conventional breeding or using GMO techniques. Using cisgenesis - genetic modification using a natural gene from a crossable plant - may prove more publicly acceptable. However, a major barrier remains the durability of resistance, testing for which should be conducted according to EUCABLIGHT's harmonised protocols.

This Guide examines the current situation in Europe, the prospects for further progress and sources of information for advisers and growers.

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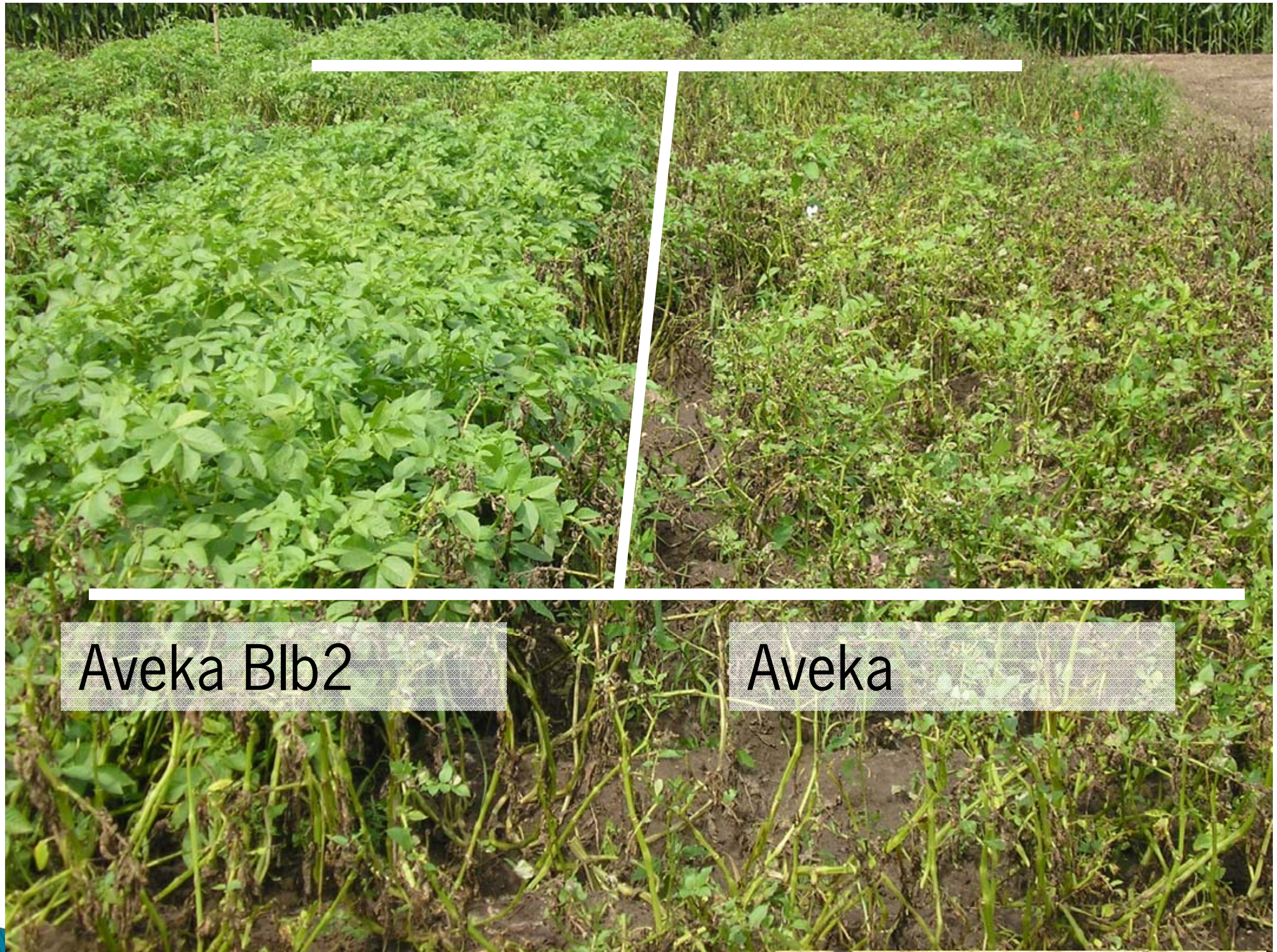
Resistant varieties



Targeted use of fungicides

From Science to Field
Potato Case Study – Guide Number 3

Fungicides for Tackling Late Blight

Summary

Fungicides play a crucial role in the integrated control of late blight. Integrated Pest Management strategies to control late blight balance a number of factors concerning fungicides including efficacy and side-effects (both environmental and toxicity) but also economic and social factors in addition to the legislation in place.

Control strategies are primarily preventive, but when blight enters the crop the strategy must focus on stopping or reducing the epidemic. This means growers and advisors need all the information and tools necessary to control blight efficiently.

A control strategy can be based on a schedule with more or less fixed intervals or based on recommendations derived from a Decision Support System (DSS). In a strategy, the first spray, product choice, dose rates, timing and last spray are important elements that can differ from country to country depending on growing conditions, varieties, registered fungicides and weather conditions.

Important phases in crop growth can also be identified: emergence to start of rapid haulm growth, rapid haulm growth, end of rapid haulm growth to start of senescence and start of senescence to complete haulm destruction. It is important that information on all these elements is available and that the adviser and/or farmer make his decisions accordingly.

This Guide identifies sources for obtaining this information and a table of fungicides registered for late blight control in five European countries.

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Fungicides for Tackling Late Blight

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A potato late blight network for Europe

Fungicide comparison - Updated 15 July 2010

The effectiveness of fungicide products/co-formulations for the control of *P. infestans* based on **highest** rate registered in Europe. These ratings are the opinion of the Fungicides Sub-Group Arras late blight workshop, 2010 and are based on field experiments and experience of the pro performance when used in commercial conditions.

Hold mouse over headers to get explanation

	Effectiveness				Mode of action			Rainfast
oduct [1]	Leaf blight [2]	New growth	Stem blight	Tuber blight	Protectant	Curative	Anti sporulant	
copper		?	●	●	●◐	0	0	●
dithiocarbamates [3]	2.0	?	●	0	●●	0	0	●◐
chlorothalonil		?	◐	0	●●	0	0	●●◐
cyazofamid	3.8	●●	●	●●●	●●●	0	0	●●●
fluazinam	2.9	?	●	●●◐	●●●	0	0	●●◐
zoxamide + **mancozeb**	2.8	?	● [5]	●●	●●●	0	0	●●◐
famoxadone + **cymoxanil**		?	●◐	N/A	●●	●●	●	●●◐
mandipropamid	4.0	●●	●◐	●● [5]	●●●	● [6]	●◐	●●●
benthiavalicarb + **mancozeb**	3.7	?	●◐ [5]	●◐	●●●	●◐	●	●●◐
cymoxanil + **mancozeb**		?	●◐	0	●●	●●	●	●●
cymoxanil + **metiram**		?	●◐	0	●●	●●	●	●●
cymoxanil + **copper**		?	●◐	0	●●	●●	●	●●
dimethomorph + **mancozeb**	3.0	?	●◐	●●	●●◐	●	●●	●●◐
fenamidone + **mancozeb**	2.6	?	●◐ [5]	●●	●●◐	0	●◐ [5]	●●
benalaxyl + **mancozeb** [4]		●●	●●	N/A	●●◐	●●◐	●●◐	●●●
metalaxyl-M + **mancozeb** [4]		●●	●●	N/A	●●◐	●●◐	●●◐	●●●
metalaxyl-M + **fluazinam** [4]		●●	●●	N/A	●●◐	●●◐	●●◐	●●●
propamocarb-HCl + **mancozeb**		●◐	●●	●●	●●◐	●●	●●	●●●
propamocarb-HCl + **chlorothalonil**	3.4	●◐	●●	●●	●●◐	●●	●●	●●●
propamocarb-HCl + **fenamidone**	2.5	●◐	●●	●●	●●◐	●●	●●	●●●
propamocarb-HCl + **fluopicolide**	3.8	●●	●●	●●●	●●●	●●	●●◐	●●◐

[1] The scores of individual products are based on the label recommendation and are NOT additive for mixtures of active ingredients. Inclusion of a product i indicative of its registration status either in the EU or elsewhere in Europe, [2] Based on EuroBlight field test in 2006-2008, [3] Includes maneb, mancozeb, pro metiram, [4] See proceedings for comments on phenylamide resistance, [5] Based on limited data, [6] In some trials there were indications that the rating was

Ratings for leaf blight is based on results from Euroblight field trials during 2006-2009, and only compounds included in these trials are rated for leaf blight. leaf blight is a 2-5 scale (see technical report). All other ratings are 1-3 scale indicated by a combination of full (1) and half (½) orange colored dots.

Key to ratings: 0 = no effect ; ● = reasonable effect ; ●● = good effect ; ●●● = very good effect ; N/A = not recommended for control of tuber blight; ? experience in trials and/or field conditions.

Whilst every effort has been made to ensure that the information is accurate, no liability can be accepted the tables or for any loss, damage or other accident arising from the use of the fungicides listed herein. C mean that it is not approved for use within one or more EU countries.

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abel recommendation for a particular product. Where the disease pressure

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Decision Support Systems

From Science to Field
Potato Case Study – Guide Number 2

Using Decision Support Systems to Combat Late Blight

Summary

Decision Support Systems (DSS) integrate all relevant information to generate spray recommendations and much can be gained by their wider adoption. DSS increase the efficacy of control strategies without increasing risk and can also be used to justify fungicide inputs and as a source of advice in situations where the number of sprays or product choice is limited by legislation.

ENDURE's Potato Case Study has considered all DSS in Europe, where all potato growing regions have one or more DSS available. These DSS can improve the efficacy of control strategies and optimal timing of sprays can, on average, produce a saving of one or two sprays per season. Applying an effective preventive strategy can also avoid dramatic disease outbreaks that have to be stopped by using intensive spraying regimes.

This Guide examines the DSS currently in use in Denmark, France, Italy, The Netherlands and Poland and what the immediate future holds for these systems. The Danish system (www.planteinfo.dk), for example, is part of the wider Web-blight monitoring network which covers all countries around the Baltic Sea. A Nordic test-and-development DSS called Blight Management is currently being used to test new applications before implementation in each country's own DSS. In France, the Plant Protection Service and ARVALIS have each developed a DSS, but are now working on a single DSS scheduled to go online from 2009.

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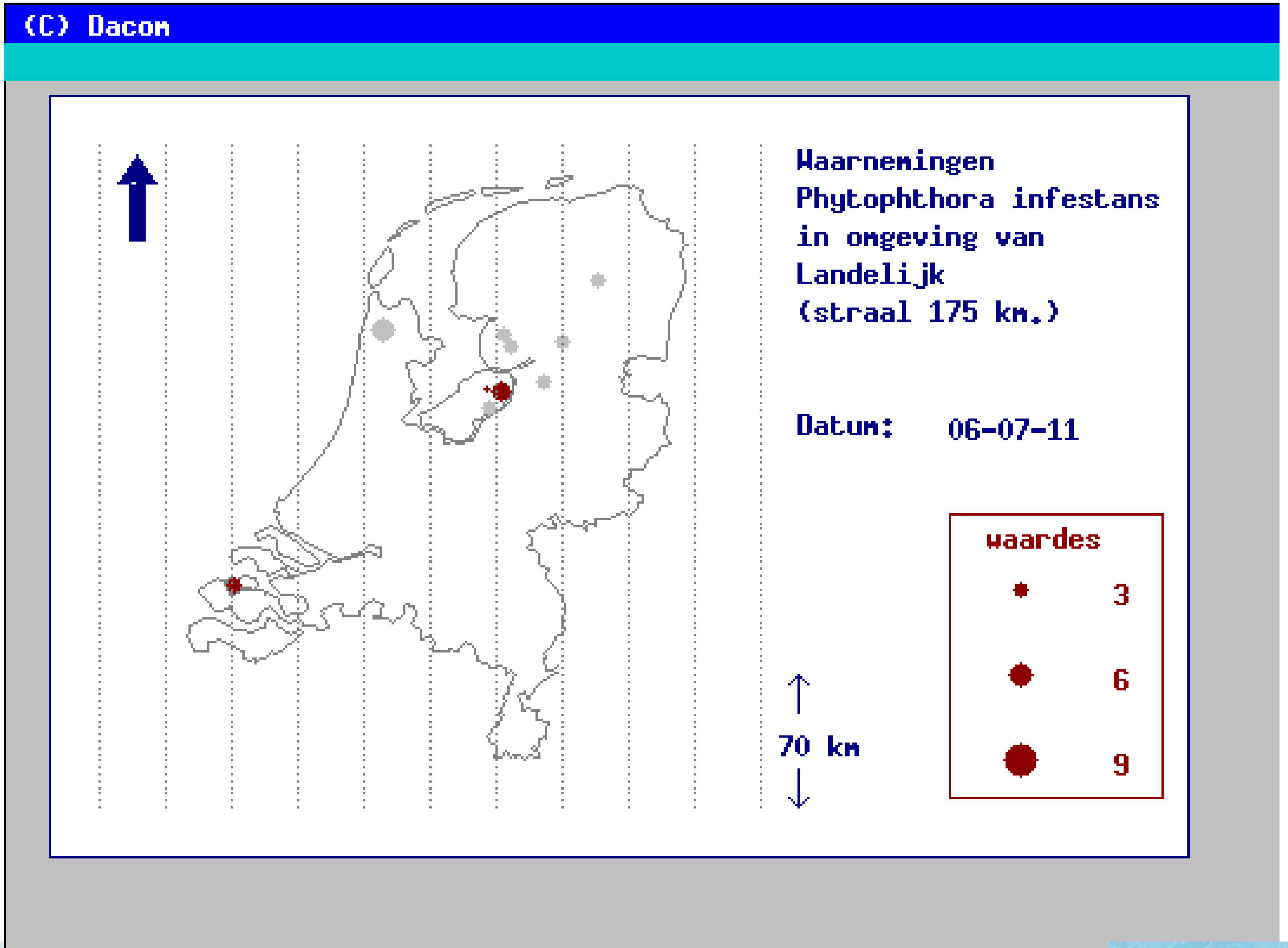
Monitoring infected fields



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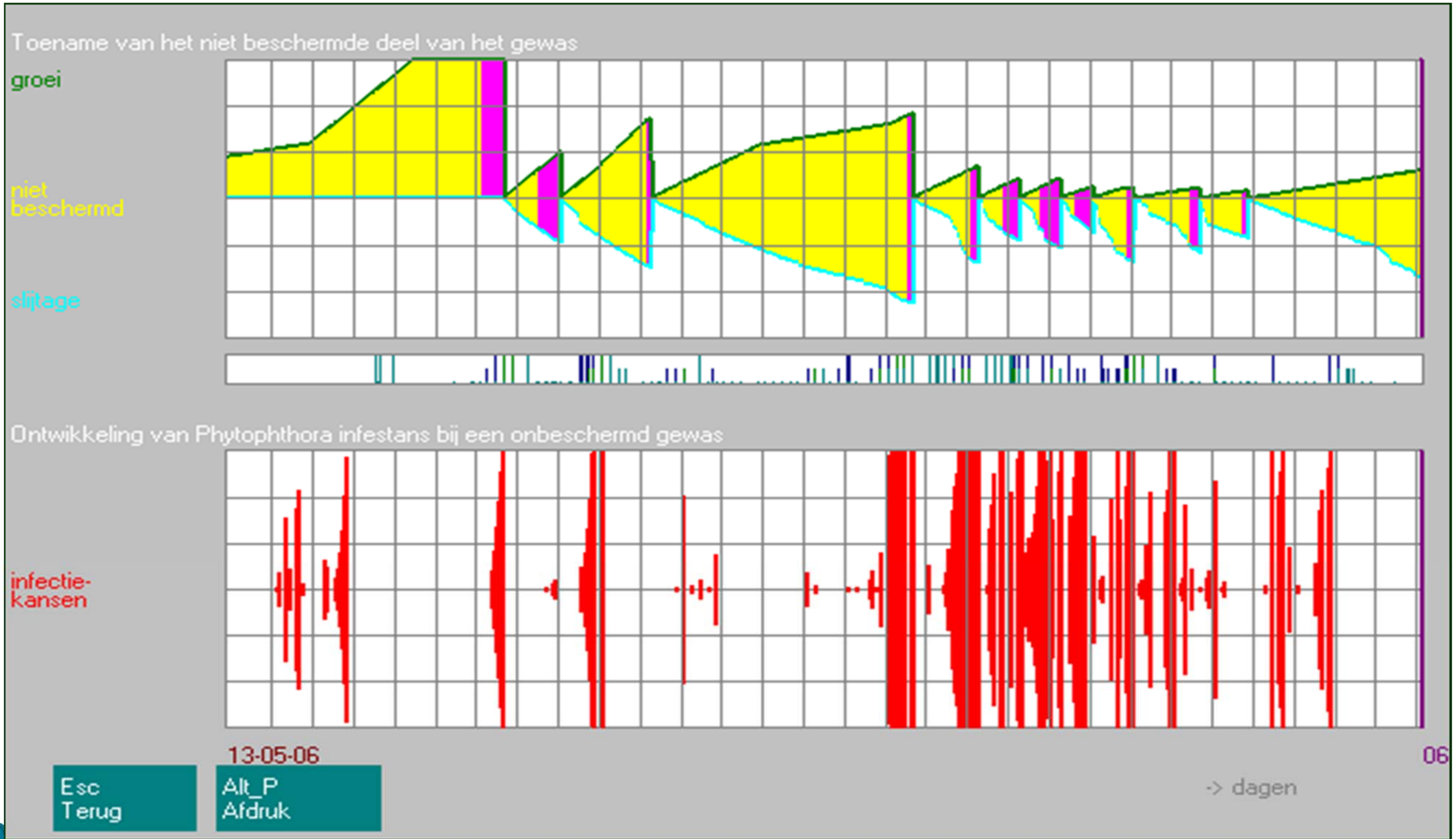
DSS: Plant-Plus (Dacom)



Conclusions *P. infestans*

- *P. infestans* will continuously adapt itself (evolution)
- 4 important Best practices
  - Reduction of **primary sources of inoculum**
  - Input of fungicides can be reduced on **varieties with a durable resistance**
  - **Fungicide** characteristics linked with disease pressure and growth stage of potato crop
  - **DSS** integrate & organize all information
- This integrated approach increases the efficacy of control, reduces the costs and environmental side effects

Thank you for your attention

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