WWW.PHYTOPHTHORA.DE - AN INTERNET–BASED WARNING SERVICE FOR LATE BLIGHT CONTROL

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ABSTRACT
In 2000 the governmental crop protection services installed an Internet-based warning service for Late Blight (www.phytophthora.de) throughout the whole Federal Republic of Germany. All relevant potato growing regions were included. The system combined results of predictive models and decision support systems, data from comprehensive monitorings in farmers’ fields and specific local advice given by extension officers. Information on the first occurrence, the epidemic development and fungicide strategy were provided to the growers. The system comprises of an interactive part in which the growers can use their own data to aid decision-making for P. infestans control. The acceptance of www.phytophthora.de was unexpectedly high. The system will be improved and integrated in a more complex information system on integrated crop production (ISIP).

Key words: Phytophthora infestans, decision support systems, DSS, SIMPHYT, monitoring, Internet, warning service, ISIP.

INTRODUCTION
In 1997 the governmental crop protection services (GCPS) decided to install and finance a central unit (ZEPP) to develop and elaborate predictive models and decision support systems (DSS). During the last three years ZEPP developed several DSS's and successfully introduced them into agricultural practices. With respect to Late Blight of potatoes the SIMPHYT – models (Gutsche & Kluge, 1996), after several years of intensive validation efforts (Kleinhenz & Jörg, 1999, 2000), meanwhile have been widely accepted in practice and have become essential tools in decision-making in P. infestans – control.

Due to reductions in staff and shortages in finances more tasks of the GCPS have been centralised and transferred to ZEPP. In January 2000 the GCPS decided to install an Internet-based warning service on Late Blight control (www.phytophthora.de) on the federal scale in Germany. All relevant potato growing regions should be included.

WWW.PHYTOPHTHORA.DE

Organisation
Work on www.phytophthora.de started in February 2000 with the valuable help and know-how from DIAS (Department of Agricultural Systems, Danish Institute for Agricultural Science, Foulum). From the beginning on it was intended to include the German Internet–based warning service into the European network installed by DIAS (Hansen et al., 1999; Jensen et al., 2000). After Denmark, Norway, Sweden, Finland and Lithuania Germany became the fifth participant in www.web-blight.net.
In spring 2000 the structure of www.phytophthora.de and the infrastructure to run the system (Fig. 1) were elaborated by ZEPP in close co-operation with DIAS and the GCPS.

1) Weather data: From 110 meteorological stations located within the potato growing regions and either owned by the GCPS or the German Meteorological Service (DWD) data required to run the SIMPHYT – models were centrally collected by ZEPP. Daily model runs were conducted automatically.

2) All results from GCPS-monitoring activities in a total of 55 growing areas and 190 surveyed potato fields as well as the advises given by the extension officers were recorded at the regional institutions of the GCPS with a specific computer program. Afterwards the information's were sent to ZEPP where they were analysed, summarised and prepared for the creation of the Internet pages.

3) Via ftp-transfer (Hansen et al., 1999) the data were transferred to DIAS where the Internet-server is located. DIAS provided the interactive Internet – pages to the user.

In 2000 a total of 3200 records were processed and more than 15000 simulation runs resp. forecasts were performed and their results have been published in the Internet.

**FIGURE 1: Data flow of Phytophthora-warning-service in Germany**

**Structure**
There are three ways to get access to www.phytophthora.de. In the www.web-blight.net you may chose „Germany“ and you will be led to the overview map of Germany. Second possibility is to directly go to this Internet – page. And thirdly all regional Internet – services of the GCPS link to this page when you ask for specific information on Late Blight control.

The information provided in www.phytophthora.de may be divided into four groups:

1) Results of SIMPHYT – models on a regional scale (first occurrence and infection pressure).

2) Results of a comprehensive monitoring which is done by the extension officers of the GCPS in regular intervals and includes a proper diagnosis.

3) Regional advice and recommendations concerning start of the spraying schedule, spraying intervals and choice of the products.
4) (Interactive) calculations of appropriate plot-specific spraying intervals on the basis of a few, simple data inserted into the system by the grower himself.

All these information combined and simplified enable the grower to optimise his strategy of *P. infestans* – control.

**Content of www.phytophthora.de**

The Internet – based warning service provides the growers with advice on the first occurrence of *P. infestans*, on the epidemic progress and actual infection pressure and on spraying intervals.

- **First Occurrence**

If the user decided to get information on the start of the Late Blight epidemic he is led to a map of the country he has chosen. An overview on the growing areas in this country is given and monitored fields (characterised by a representative weather station) are identified by spots of different colours (Fig. 2).

The colours inform on the status of Late Blight in the fields as follows:
- „green“ = *P. infestans* – occurrence is neither predicted by SIMPHYT1 nor has it been recorded during the GCPS monitoring.
- „yellow“ = *P. infestans* – occurrence has been predicted by SIMPHYT1 but has not been recorded yet in the region.
- „red“ = *P. infestans* – occurrence has been recorded by the monitoring.

Thus a rough overview is given on the start of the epidemic in a region and the surrounding growing areas. More specific results are presented in a table if the user clicks on a certain coloured spot (Fig. 3).

1) In the left part of the table SIMPHYT1 forecasts for the three main emergence date classes in the region are shown, specified according to a high or an average „risk“.

2) Results of the GCPS monitoring are presented in the right part of the table. Municipality and date of the first record of *P. infestans* in the region is shown and in addition the circumstances are described (occurrence in a housegarden, irrigated field, a field under plastic cover, normal field).

3) In a text-box below the table specific advice is given to the farmers of the region. Normally the text contains information on distribution of *P. infestans* in the region, decision – making (cultivars to be treated or products to be used) but also on further pests and diseases that occur.

Local institutions and extension officers in charge of crop protection are named and quick contact via email is possible to obtain more information if necessary.

- **Further Epidemic Progress**

Once the epidemic has started information is needed on the epidemic progress to plan the fungicide schedule properly. www.phytophthora.de presents SIMPHYT3 (Gutsche et al., 1999) results and assessments in farmers’ fields to aid decision-making. Information are presented analogous to those on the first occurrence.

A map again gives an overview on *P. infestans* infection pressure in a country. Again spots indicate the fields which are monitored. From the colours the infection pressure and Late Blight risk can be seen. In five categories from green (=low pressure) via yellow and orange to red (=very high pressure) the SIMPHYT3 results are presented.

For more detailed information a table and a special graphical presentation of SIMPHYT3 results are available.

1) The table informs on the monitoring results in farmers’ fields. In most of the cases two or three fields per region in the vicinity of a weather station are monitored. The table shows the municipality, the cultivars grown, date of last assessment, and the number of
treatments which have been applied up to the actual day. In addition *P. infestans* occurrence in an untreated plot within the field is registered and the disease incidence in the treated part of the field is assessed and roughly categorized.

2) Furthermore in the table SIMPHYT3 infection pressure calculated for all weather stations in the region is shown and from it a mean length of spraying interval is derived.

3) Again extension officers give specific advice on spraying schedules and local information which is presented in a text-box. All SIMPHYT3 results can be clicked on. Infection pressure over time and pew-values which classify the days according to their *„P. infestans – efficiency“* then are presented in a graph.

- **Interactive Part**

By inserting simple but specific data on an interactive page the farmer can modify the mean regional spraying interval according to his field conditions. The system needs information on crop growth, cultivar susceptibility, the last fungicide application and local precipitation (Fig. 4). Depending on the constellation the length of the spraying interval may be reduced or increased up to three days. In case of sporulating lesions in the field the system reduces the spraying interval to zero days and recommends a quick contact to the local extension officer to get information on emergency treatments.

**ACCEPTANCE**

Although almost no advertising for www.phytophthora.de was done the interest in the Internet-based warning service was very high. A total of about 3000 different users have been identified. From June to September a user statistic was available and it is known how often the warning service has been requested. Farmers and advisors showed greatest interest in June when ca. 25000 accesses to the Internet-pages were registered. In July 14000 visits happened. After the end of the vegetation period for very early, medium early and early cultivars had ended the interest decreased (August and September: 6300 and 600 accesses resp.). In total about 45000 requests were registered in 2000.

**OUTLOOK**

After a successful introductory phase www.phytophthora.de will be offered to the potato growers also in the future. The assessments have to be rationalized and improved. Data transmission (meteorological data and field data) has to be optimised. Careful changes in the Internet - presentations have to be made and more aid to the interpretation of the results has to be given to the user (farmer).

In 2001 a validation method for SIMPHYT3 – output will be elaborated because the potential of the model’s results yet is not fully exploited. In addition we aim at a validation of the field – specific spraying strategy of the farmers to identify „hot spots“ where an improvement is necessary.

In 2001 a project has started on the elaboration of a comprehensive Internet – based information system on integrated crop production (ISIP) in which data and information of many external sources can be linked and processed. The intention is to provide the farmers with modules for each crop. As a study revealed the users of such a system mainly are interested in information on crop protection, especially on pest and disease occurrence and decision support. www.phytophthora.de will be one of the essential parts of the potato – module of ISIP.
FIGURE 2: Overview on first appearance of *P. infestans* and first fungicide treatment

FIGURE 3: Detailed information's on Late Blight first appearance and recommendations given by the advisory service
FIGURE 4: Site specific recommendation of spraying interval (interactive internet page)

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REFERENCES


