Internal Report

Entry and transfer of host resistance information to the EUCABLIGHT database

User manual

Jens Grønbech Hansen, Poul Lassen & Leontine Colon

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Danish Institute of Agricultural Sciences

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Foreword

This user manual was produced in the frame of the EUCABLIGHT concerted action (2003-2006). Only 100 copies will be hard copied due to expected updates. This version or an updated version of the user manual will also be available on the EUCABLIGHT web site (http://www.EUCABLIGHT.org).

Foulum, 6 January, 2006

Jens Grønbech Hansen, Poul Lassen and Leontine Colon

Contents

1 Introduction to host resistance information

1.1 Late blight

Late blight (caused by the oomycete pathogen *Phytophthora infestans*) first occurred in European potatoes in 1845, when *P.infestans* was imported from its centre of origin, which is thought to be the Toluca Valley in Mexico. The disease was first noted in Belgium, and spread rapidly to The Netherlands, France, Britain and Ireland where it was responsible for causing famine in 1845-1848 (Bourke, 1964). In the 160 years since this introduction, *P.infestans* has remained one of the most devastating potato pathogens in Europe.

Almost immediately after the appearance of late blight, attempts were made to solve the problem using host resistance in the form of *Solanum demissum*, a Mexican relative of the potato (*S. tuberosum*). This wild species was used as alternative crop (Lindley, 1848; Jühlke, 1849) and, without much success, as a source of major resistance genes in potato breeding programs around 1850 (Focke, 1881). It was used again between 1909 and 1950, with the first resistant cultivars appearing on the market around 1930 (Müller & Black, 1952).

Figure 1. Symptoms of late blight, caused by *Phytophthora infestans*, on a potato leaf

Unfortunately, virulent strains of the pathogen overcame this resistance as early as 1849 (Jühlke, 1849) and have continued to do so. Virulence is usually a recessive trait, and European *P. infestans* strains are often polyploid, which allows them to store large numbers of unexpressed virulence genes in their genetic background without fitness costs. Virulent strains originating from this hidden reservoir have an enormous capacity to multiply rapidly and spread over long distances. Strains with virulence for all 11 R genes from *S. demissum* occur worldwide, although some virulence factors are less frequent, such as Avr8 and Avr5 or rare, such as Avr9. As a result, breeders have turned to new sources of major genes such as the Mexican species *S. bulbocastanum* or the South American species *S. microdontum*, using both direct gene transfer and traditional breeding methods.

The implementation of strategies for the integrated control of potato late blight with reduced inputs of fungicides would benefit if durable blight resistance were more common in commercial potato cultivars. This includes both foliage and tuber resistance, since the pathogen also attacks tubers. Durable resistance, often termed field resistance, or race-non-specific (or horizontal) resistance, does exist. However, in potato this is usually associated with late maturity and is selected against in breeding, because breeders highly favour early genotypes. Many sources of late blight resistance exist in wild and primitive potatoes and developed cultivars, but the nature of that resistance is often poorly understood. The current European data on host resistance are fragmented and the methods used to collect this data are often not well documented.

The effective deployment of resistant commercial cultivars creates a “moving target” for *P. infestans*, but such a strategy can only be effective if we understand the existing pathogen population structure and can predict its ongoing evolution. *Phytophthora infestans* populations have undergone many significant changes since 1845, with several major migration events (Fry et al, 1992), adaptive response to new resistance genes or agrochemicals introduced to combat the pathogen (Wastie, 1991), and the recent occurrence of sexual reproduction in several parts of the European continent (Drenth et al., 1994). Many studies on the structure and evolution of these populations have been undertaken, but there is still a lack of general understanding of the mechanisms involved, including for instance the extent of metapopulation structures and the impact of local and long scale migrations.

The collation of the available data by EUCABLIGHT into a harmonised and readily accessible database will allow breeders and geneticists to compare or exploit sources of resistance in their breeding programmes. Other target groups are farmers and advisers using Decision Support Systems, who need reliable information about the aggressiveness of the late blight population and the level and stability of resistance in the potato cultivars in their region.

1.2 EUCABLIGHT

The European Concerted Action on Blight, or,"EUCABLIGHT" (A Late Blight Network for Europe, www.EUCABLIGHT.org) as it will be known, is co-ordinated by the Scottish Crop Research Institute in Dundee, Scotland and will run for 3 years (2003-2006). The EUCABLIGHT consortium consists of a group of 24 European partners from 14 European countries with varied expertise in both host and pathogen research.

The European Union's Concerted Actions are intended to support the co-ordination of RTD tasks already financed at national level where the pooling of data would facilitate common interpretation of facts and contribute to the development of harmonised standards, procedures, methodologies, processes or common research instruments.

The project will be organised in three geographic regions: Western Europe, which will be administered by Didier Andrivon at INRA, Central Europe (Ewa Zimnoch-Guzowska, IHAR) and Nordic Europe (Arne Hermansen, NCRI). There are two themes that run across these regions. The first, "Characterising host resistance" will be led by Leontine Colon at PRI in The Netherlands and the second "Characterising pathogen variation" by David Cooke at SCRI. The databases and website will be implemented by Jens G. Hansen and Poul Lassen at DIAS in Denmark.

1.3 Why sampling host resistance information?

The implementation of integrated control of late blight with reduced inputs of fungicides would benefit if durable blight resistance were more common in commercial potato cultivars. Many sources of resistance exist in wild, primitive and developed cultivars but the nature of that resistance is often poorly understood. Standardised sampling of host resistance information will enable us to allow rational and objective comparisons of genetic resources.

The available European data on host resistance is fragmented and often the methods used to collect this data are not well documented. We aim to collate the available data into a harmonised and readily accessible database so as to allow breeders and geneticists to compare or exploit sources of resistance in their breeding programmes.

1.4 Data collection and transfer to EUCABLIGHT database

Protocols for assessing biological, pathogenic and genetic diversity vary between laboratories engaged in host resistance and population analyses of P. infestans worldwide, but also in Europe. These differences make the comparison of data collected by different teams difficult, and sometimes downright impossible. Furthermore, technologies for the analysis of genetic

and phenotypic diversity evolve rapidly. Therefore, one of the main objectives of EUCABLIGHT is to collate, formalise, assess and recommend the most suitable protocols, through the collective work of its members. These protocols are available through a dedicated section of the EUCABLIGHT website. The overall aim is to provide reliable, standardised methodologies generating readily comparable data, and to facilitate the use and adoption of improved protocols for future work.

The incorporation of seven standard cultivars into trials is a major requirement of the protocols. The standard cultivars have been chosen on the basis of their availability and the expected durability of the resistance, and represent the extremes of susceptibility and resistance in the three maturity classes "first early" (Eersteling and Gloria), "maincrop" (Bintje and Escort) and "late" (Alpha and Robijn). Sarpo Mira, was added to represent the highest resistance class, although the durability of its resistance has yet to be established. To facilitate the dissemination of the seven standards, they have been distributed as seed potatoes. They are also being made available from the Scottish Agricultural Science Agency (SASA) in East Craigs as in vitro cultures. In addition to these standards, the inclusion of SASA's 11 single R gene differentials R1 – R11 is also recommended to ensure that high resistance scores are not only the result of a simple pathogen race structure.

The protocols were compiled by members of the "host" and "pathogen" technical groups of EUCABLIGHT, and discussed during project meetings before validation as "EUCABLIGHT Recommended protocols". The following type of data will be collected in the frame of EUCABLIGHT:

1. Foliage test field resistance
2. Maturity field assessment
3. Detached leaflet assay
4. Whole tuber lab test
5. Tuber slice test
6. Tuber field test
7. Glasshouse whole plant

Please find protocols for these trials under the Protocols section on the EUCABLIGHT web site.

The protocols will be used from the 2004 season onwards. Only data collected using these methods will be included in the EUCABLIGHT database. In this way, the data will be fully comparable across years and locations.

Additionally, we will collect data from trials carried out in previous years in Europe. The protocols have been developed for foliage blight resistance, tuber blight resistance and maturity. These can be found on the EUCABLIGHT web site. To accommodate the different types of trials that are commonly used in Europe, there is more than one protocol for each trait, except

maturity. For foliage blight resistance, data can be collected in the field, in a whole plant greenhouse assay and in a detached leaflet test. Tuber blight data can be collected either in the field, or in the lab, in the latter case using whole tubers or tuber slice tests.

Maturity was included because maturity has a strong influence on the expression of genes for foliage blight resistance, especially QTLs, and resistance information is meaningless without knowing the maturity type of the same variety.

1.5 Cultivar database

In order to monitor the resistance of a cultivar from the time of first selection, the database contains data from both cultivars and breeding lines. A database with details of more than 4000 cultivars will help to link the identities of breeding lines to cultivars, and to avoid duplicated entries due to misspellings. This section of the EUCABLIGHT database also contains data relating to presence of R genes, fertility, use (ware, processing or starch) and ploidy level of the germplasm, collated from published and unpublished sources.

1.6 Data handling and Statistics

We are only collecting primary data (including replicates). When you enter your primary data into a predefined Excel spreadsheet, we import and then process your data. You can now compare your own primary results (as RAUDPC, apparent infection rate, number of days till first symptoms, 1-9 scale values etc.) with similar results from other regions and years in Europe. Primary data and primary results will only be available for the owner of the data. The collection of primary data makes it possible to evaluate the results using several statistical methods including new ones generated by the EUCABLIGHT project. Secondly, the evaluation of primary results from previous years may be a contribution to the discussion how discrepancies in resistance scores for the same varieties are due to the historical use of different methods for resistance evaluation. At the web site you will find a documentation of all statistical methods applied.

1.7 Overviews of results in EUCABLIGHT

The data will be presented as genotypic averages for each of the seven protocols used. Users will be able to see these averages by country or region, and by year. Users will not be able to extract the primary data. The averages will be accompanied by statistical information such as standard error and number of replicates.

The user will be able to choose if the information will be presented in tables or graphs. The unique feature of the EUCABLIGHT database is that it also contains information about the late blight populations in the regions and years of resistance testing. This will allow correlation of resistance genes in the host with virulence genes in the pathogen and predictions of durability of resistance.

There is no limit to the amount of data the database can handle. Reliability and informativity will of course be better if more primary data are available. New varieties can be added at any time and their data will be linked to earlier data of the yet unnamed breeding line.

1.8 Intellectual Property Rights

Primary data will remain the exclusive intellectual property of, and will only be available to the owner of the data.

The summarising information in the database, generated from several (at least 50) primary datasets, is in the public domain, and freely available for use. Such information would for example be the average foliage resistance level of a certain variety to natural infections across Europe in the years 2004-2014. Publication of this summarising information is only possible when proper reference is made to the EUCABLIGHT website as the source of the information.

1.9 How to participate?

TG1 (Leontine Colon, Bent Nielsen, Ulrich Darsow) is the quality control body to decide which trial results can be uploaded. Please offer your trial to TG1 by E-mail
For each trial you need to E-mail us this information:

1. Trial type (foliage field, foliage detached leaf, etc.)
2. Trial responsible person' s (RP) name
3. Trial institution
4. Trial site name
5. Trial year
6. Trial country
7. Trial region (select Region menu and find region name and ID for your trial)
8. A description of the trial including comments if your trial setup is different than recommended in the EUCABLIGHT protocols, especially if some or all of the standards are missing or, if you have less than 5 disease assessments over time.

If your trial is accepted by TG1, your trial ID information is sent to the EUCABLIGHT manager for upload to the EUCABLIGHT database. The trial ID will be associated with your

EUCABLIGHT member ID. When you log into EUCABLIGHT and select Host menu, your trial will be visible via the “Trial overview table” and in your personal “Trial Manager”. If you are not a EUCABLIGHT member, username and password will be sent to you via e-mail. How to use the Trial Manager is explained in section 3 and 4.

1.10 Quality control

The following points will be taken into account:

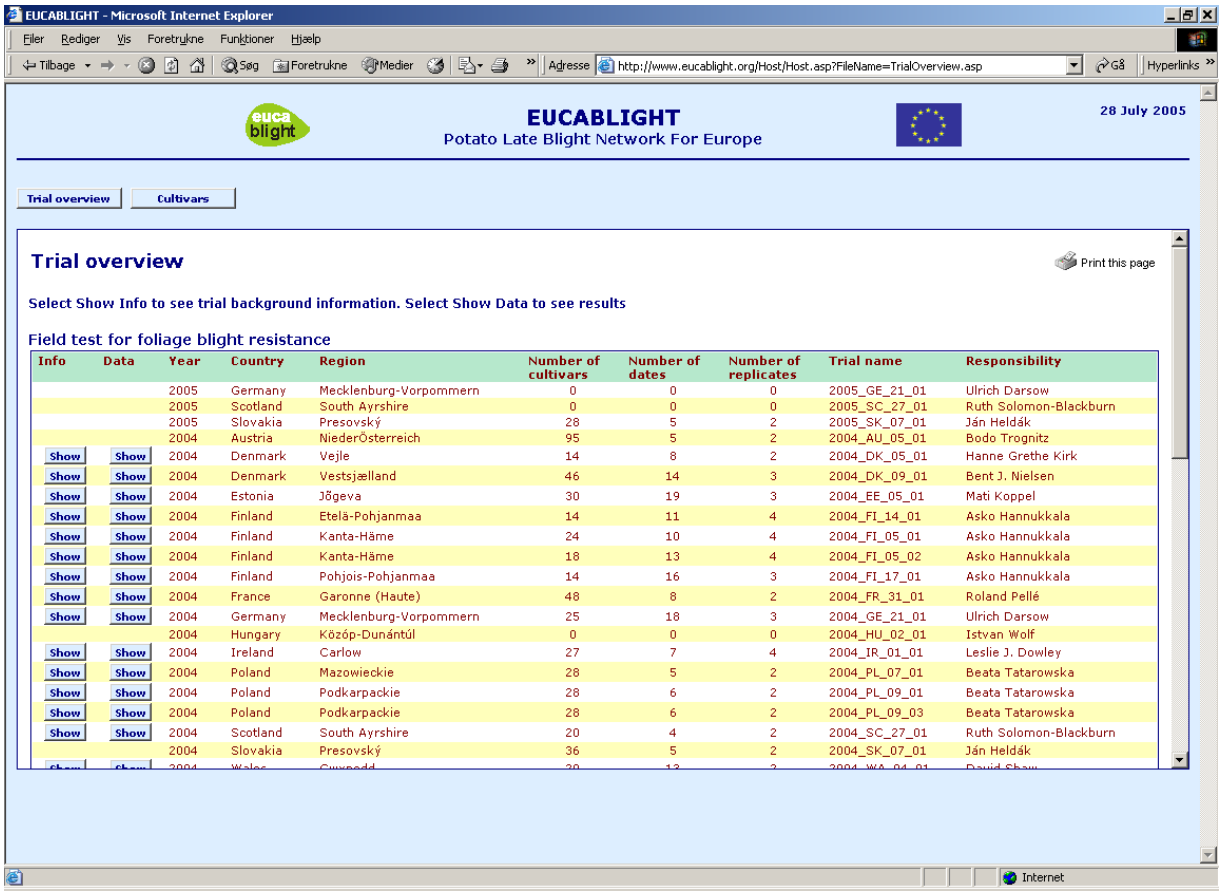
- For foliage field trials: Do you have enough disease assessments over time, and do they include the relevant part of the epidemic
- Are all the standards (7 varieties, 11 R-gene differentials) included?
- Is the number of missing values acceptable

2 Software and hardware requirements

Based on trial information, EUCABLIGHT generates a text file with identification of trial data. This file is imported into Excel where the primary results are entered and sent to EUCABLIGHT for storage in the database. Background trial information is entered into the database via special web pages based on Trial ID and trial type. The primary disease data and the background data are merged in the database based on the trial Ids. You need a PC, Excel, a browser and Internet connection for these operations.

3 Getting started with upload of host resistance information

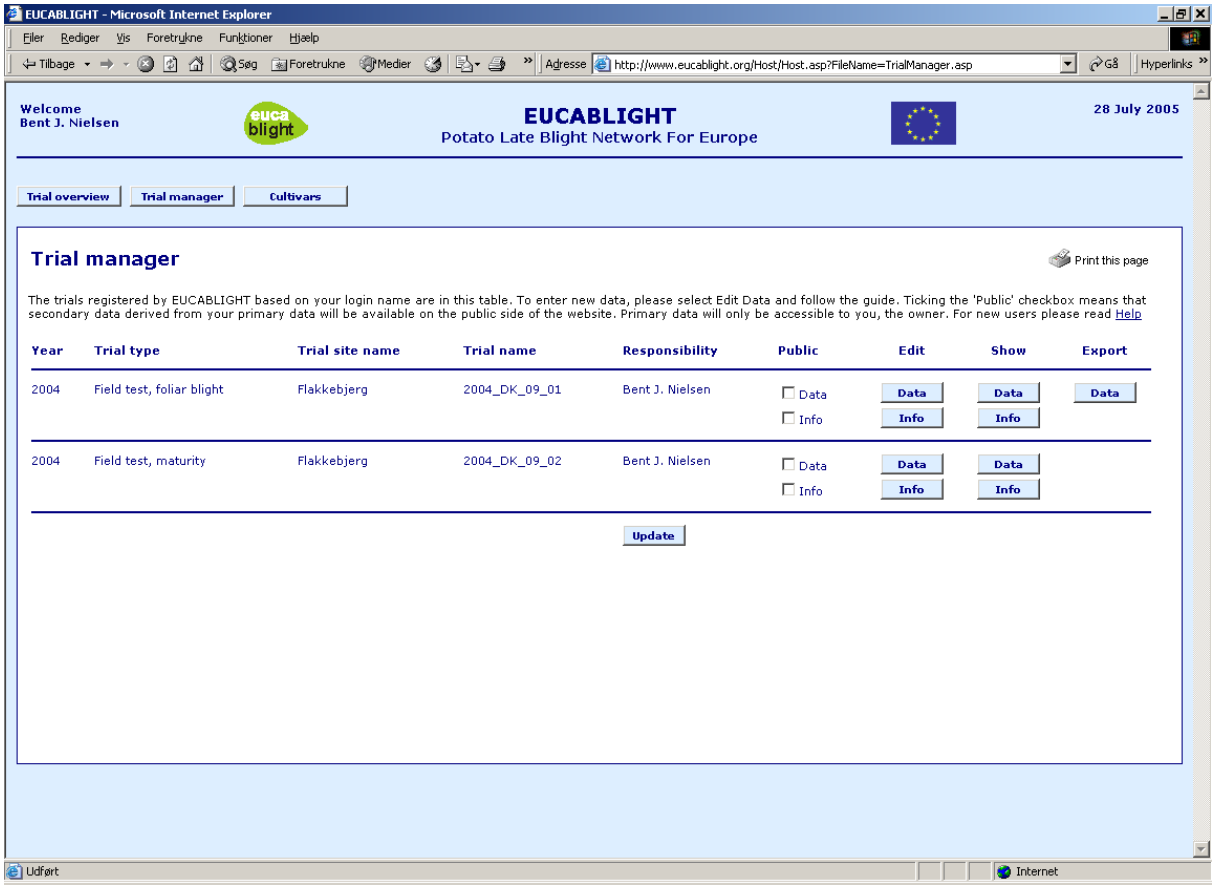
1. After login to the EUCABLIGHT web site, then open your personal Trial Manager via Results/Host.
2. Enter background information for your trial via Edit Info in the Trial manager
3. Select Edit Data to generate an Excel-file for storage of primary results.
4. Send your Excel file with primary data to the host resistance technical (TG1) group for quality control.
5. After quality control, your data will be uploaded to the database. You will be announced via e-mail.
6. Select Show Data to see your results as graphs of disease progress curves, tables with mean disease data by date or derived statistics from the disease progress curve (AUDPC, AIR, Delay etc Additionally you can analyse your data via the Graphic analysis tool and you can compare your results with results from other similar trials.
7. Select Export data to download your results in Excel files.



Info	Data	Year	Country	Region	Number of cultivars	Number of dates	Number of replicates	Trial name	Responsibility
		2005	Germany	Mecklenburg-Vorpommern	0	0	0	2005_GE_21_01	Ulrich Darsow
		2005	Scotland	South Ayrshire	0	0	0	2005_SC_27_01	Ruth Solomon-Blackburn
		2005	Slovakia	Presovský	28	5	2	2005_SK_07_01	Ján Heldák
		2004	Austria	NiederÖsterreich	95	5	2	2004_AU_05_01	Bodo Trognitz
Show	Show	2004	Denmark	Vejle	14	8	2	2004_DK_05_01	Hanne Grethe Kirk
Show	Show	2004	Denmark	Vestsjælland	46	14	3	2004_DK_09_01	Bent J. Nielsen
Show	Show	2004	Estonia	Jõgeva	30	19	3	2004_EE_05_01	Mati Koppel
Show	Show	2004	Finland	Etelä-Pohjanmaa	14	11	4	2004_FI_14_01	Asko Hannukkala
Show	Show	2004	Finland	Kanta-Häme	24	10	4	2004_FI_05_01	Asko Hannukkala
Show	Show	2004	Finland	Kanta-Häme	18	13	4	2004_FI_05_02	Asko Hannukkala
Show	Show	2004	Finland	Pohjois-Pohjanmaa	14	16	3	2004_FI_17_01	Asko Hannukkala
Show	Show	2004	France	Garonne (Haute)	48	8	2	2004_FR_31_01	Roland Pellé
Show	Show	2004	Germany	Mecklenburg-Vorpommern	25	18	3	2004_GE_21_01	Ulrich Darsow
		2004	Hungary	Közép-Dunántúl	0	0	0	2004_HU_02_01	Istvan Wolf
Show	Show	2004	Ireland	Carlow	27	7	4	2004_IR_01_01	Leslie J. Dowley
Show	Show	2004	Poland	Mazowieckie	28	5	2	2004_PL_07_01	Beata Tatarowska
Show	Show	2004	Poland	Podkarpackie	28	6	2	2004_PL_09_01	Beata Tatarowska
Show	Show	2004	Poland	Podkarpackie	28	6	2	2004_PL_09_03	Beata Tatarowska
Show	Show	2004	Scotland	South Ayrshire	20	4	2	2004_SC_27_01	Ruth Solomon-Blackburn
		2004	Slovakia	Presovský	36	5	2	2004_SK_07_01	Ján Heldák

Trial overview table in EUCABLIGHT

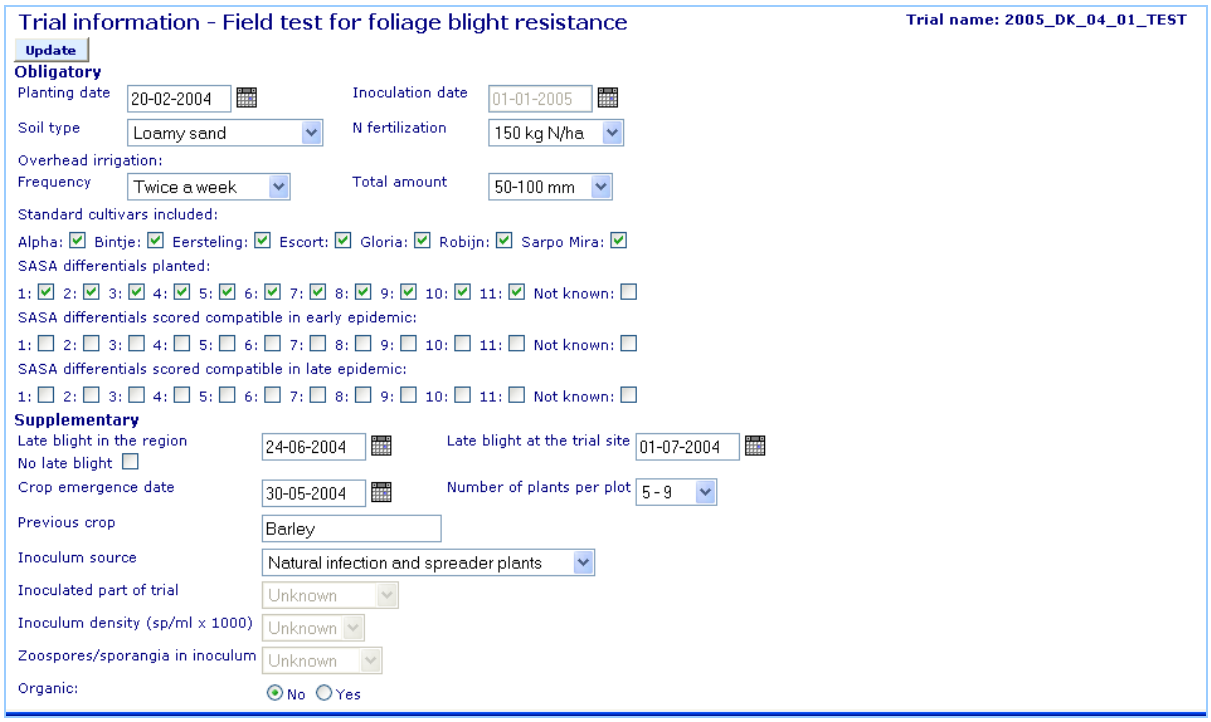
4 Trial manager



Fields and buttons	Explanation
Trial Manager	The Trial manager is your personal area for preparing Excel spreadsheets for primary data upload, for showing and exporting primary and derived data and for editing and showing your trial background information.
Trial ID	When you log into EUCABLIGHT and select the menu Results/Host resistance, the Trial Manager including the trial IDs for your trial will be available. Information about Year, Trial type, Trial site name and Trial name were provided by EUCABLIGHT TG1, based on information from you (see section 1.9).
Public Data	Averages and other statistics of your secondary data are public by default, because the value of the database lies in sharing our results. However, you have the possibility not to show these on the public side by unselecting this checkbox.
Public Info	Unselect this checkbox to keep your background data only available after login.
Edit Data	Select Edit Data to prepare an Excel spreadsheet for entrance of your primary data
Edit Info	Select Edit Info to enter background information about your trial.
Show Data	Select Show Data to show your primary data that were uploaded to the EUCABLIGHT database
Show Info	Select Show Info to show background information entered about your trial
Export data	Select Export data to download your primary data, mean disease data by date or derived statistics from the disease progress curve (AUDPC, AIR, Delay etc.). The files are in csv semicolon (;) separated format that easily can be imported into Excel or any software that can read text files

5 Field test for foliage blight

5.1 Edit Info – Field test for foliage blight



Trial information - Field test for foliage blight resistance

Trial name: 2005_DK_04_01_TEST

Update

Obligatory

Planting date 20-02-2004 Inoculation date 01-01-2005

Soil type Loamy sand N fertilization 150 kg N/ha

Overhead irrigation:

Frequency Twice a week Total amount 50-100 mm

Standard cultivars included:

Alpha: ☑ Bintje: ☑ Eersteling: ☑ Escort: ☑ Gloria: ☑ Robijn: ☑ Sarpo Mira: ☑

SASA differentials planted:

1: ☑ 2: ☑ 3: ☑ 4: ☑ 5: ☑ 6: ☑ 7: ☑ 8: ☑ 9: ☑ 10: ☑ 11: ☑ Not known: ☐

SASA differentials scored compatible in early epidemic:

1: ☐ 2: ☐ 3: ☐ 4: ☐ 5: ☐ 6: ☐ 7: ☐ 8: ☐ 9: ☐ 10: ☐ 11: ☐ Not known: ☐

SASA differentials scored compatible in late epidemic:

1: ☐ 2: ☐ 3: ☐ 4: ☐ 5: ☐ 6: ☐ 7: ☐ 8: ☐ 9: ☐ 10: ☐ 11: ☐ Not known: ☐

Supplementary

Late blight in the region 24-06-2004 Late blight at the trial site 01-07-2004

No late blight ☐

Crop emergence date 30-05-2004 Number of plants per plot 5 - 9

Previous crop Barley

Inoculum source Natural infection and spreader plants

Inoculated part of trial Unknown

Inoculum density (sp/ml x 1000) Unknown

Zoospores/sporangia in inoculum Unknown

Organic: ◉ No ○ Yes

Fields and buttons	Explanation
Planting date	Press the calendar button and select the planting date of the potatoes.
Inoculation date	Press calendar button and select the date of artificial inoculation in the trial. If inoculum source was natural infection then select the date when first symptoms occurred in the trial.
Soil type	Select via drop down box the soil type in the trial.
N-fertilization	Select the total amount of N fertilization applied.
Frequency of irrigation	Select the frequency of irrigation. If irrigation was carried out only a few times (irregularly) then select Less as required.
Amount of irrigation	Select the total amount of irrigation as close as possible to options available.
Standard cultivars Included	Mark in the checkboxes which of the standard cultivars were included in the trial.
SASA diff. Planted	Mark in the checkboxes which of the SASA's differentials were planted. If none of these clones were planted, then select Not known.
SASA diff. Scored Compatible	Mark in the checkboxes if late blight symptoms appeared in each of the SASA's differentials. If none of these clones were planted, then select Not known.
Late blight in the Region	Press the calendar button and select the date when late blight appeared in the region (5-10 square km radius).
Late blight in the trial	Press the calendar button and select the date when late blight appeared at the trial site.
Crop emergence	Press the calendar button and select the date of crop emergence.
Number of plants per plot	Select the number of plants per plot via the drop down box
Previous crop	Write in the text box the name of the previous crop.

Inoculum source

Select the source of inoculum via the drop down box

Inoculated part of trial

Select the part of the trial that was inoculated. If natural infection then select Whole trial

Inoculum density

Select the inoculum density used for artificial inoculation. If natural infection then select <5 sp/ml x 1000.

Zoospores/sporangia in inoculum

Select the type of inoculum. If unknown or natural infection then select Unknown.

Organic

Select via radio button if the trial was grown organic or not.

Comments

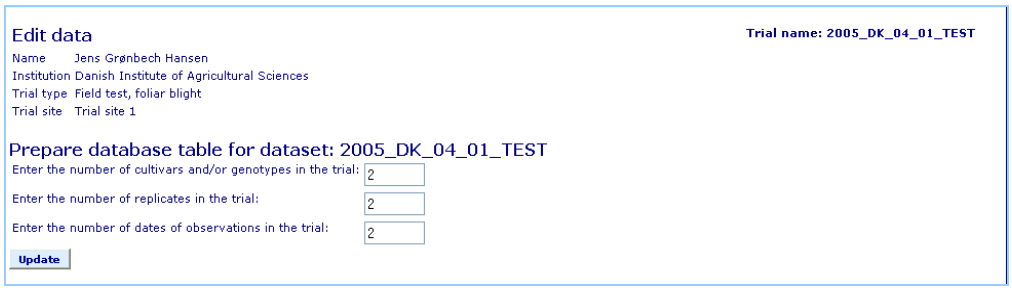
Write comments about the trial i.e. use of fungicide, type etc., if a primary attack was observed (uneven disease development) or anything special.

Update

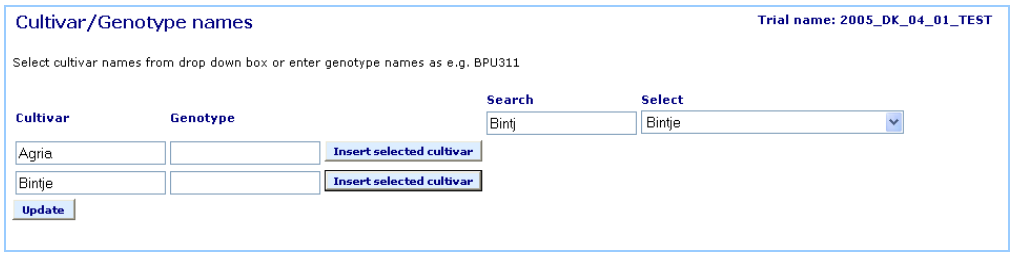
When you have entered all information, then select Update to store your information in the EUCABLIGHT database.

5.2 Edit Data – Field test for foliage blight

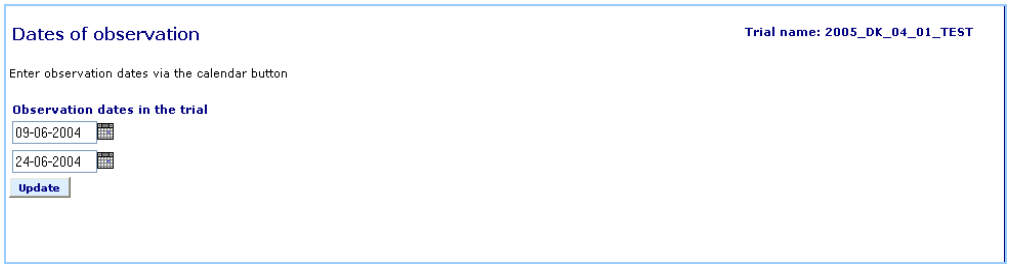
Step 1



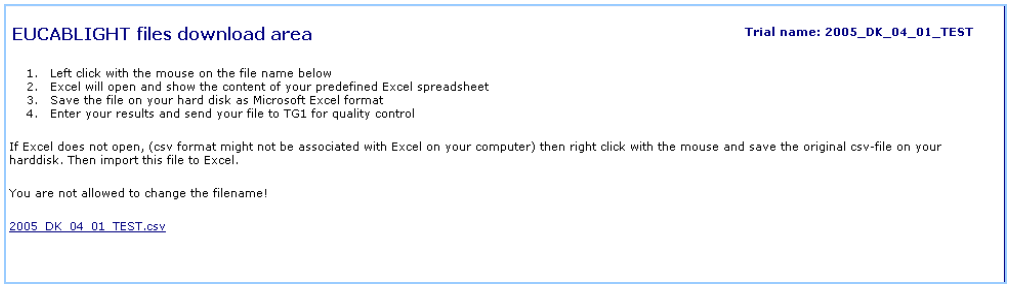
Step 2



Step 3



Step 4



Fields and buttons	Explanation
Step 1	When you select Edit data on the Trial manager main page, a new page opens for entrance of: 1. Number of varieties and/or genotypes in the trial/experiment 2. Number of replicates in the trial/experiment 3. Number of dates of observations in the trial/experiment This information is used for generation of the Excel spreadsheet for entrance of your primary data for disease assessments. When you have entered your numbers of varieties, replicates and dates, select Update to go to next step.
Step 2	Select cultivar names from the Select drop down box. To find a cultivar name among the 4000 names in the list you can search via the Search box. Write B, and the list will start at cultivar name Babanki. Write Bi, and the list will start with Biason. Scroll and find the correct name. Some varieties may be hard to find, for example Mira is under S as Sarpo Mira and Timo is under H as Hankkijan Timo. If a variety in your trial is not in the list, then contact TG1, to include this in the list. For breeding line names write the code name directly in the text box for Genotype name.
Step 3	Select the Calendar button and select the dates of observations in the trial. This information is used for generation of the Excel spreadsheet for entrance of your primary data for disease assessments. Using the Calendar button, you can shift between years, ≪ < September 2005 > ≫, and between months < ≪ September 2005 ≫ >. Select Update to go to next step.
Step 4	In the final step, the EUCABLIGHT database has now generated a csv file that you should use for entrance of your primary disease data. Right click with the mouse on the file name. If your default Windows separator is set to semicolon (;), then Excel will automatically open and read the file. Select Save as – change the file format to Excel – enter the file name as given on the files download area web page, and then save the file on your harddisk. If the file is not opened correctlyly, then save the csv file to your harddisk via left click on the file name. Then import the file to Excel and save as Excel format. Sort your original data according to the format in the EUCABLIGHT Excel file and copy and past your data into the EUCABLIGHT Excel spreadsheet. Finally, send this Excel with your data to the TG1 group for quality control. You will then be announced via e-mail when your data have been uploaded to the database (Ok in Trial overview table).

5.3 Show Info – Field test for foliage blight

Trial information [Name: 2005_DK_04_01_TEST] Print this page

Trial type	Field test, foliar blight
Trial responsible	Jens Grønbech Hansen
Trial institution	Danish Institute of Agricultural Sciences
Trial site	Trial site 1
Trial year	2005
Trial country	Denmark
Trial region	Århus

Obligatory

Planting date	20 February 2004
Inoculum date	Not relevant
Soil type	Loamy sand
N Fertilization	150 kg N/ha
Overhead irrigation frequency	Twice a week
Overhead irrigation total amount	50-100 mm
Standard cultivars included	Alpha, Bintje, Eesterling, Escort, Gloria, Robijn, Sarpo Mira
SASA differntials planted	(1;2;3;4;5;6;7;8;9;10;11)
SASA differentials scored compatible in early epidemic	Not known
SASA differentials scored compatible in late epidemic	()

Supplementary

Late blight in the region	24 June 2004
Late blight at the trial site	01 July 2004
Emergence date	30 May 2004
Number of plants per plot	5 - 9
Previous crop	Barley
Inoculum source	Natural infection and spreader plants
Inoculated part of trial	Not relevant
Inoculum density (sp/ml x 1000)	Not relevant
Zoospores/sporangia in inoculum	Not relevant
Organic	No

Comments

Several organic fields are grown in the area

When you select Show Info in the Trial manager, it shows all information you have entered via Edit Info.

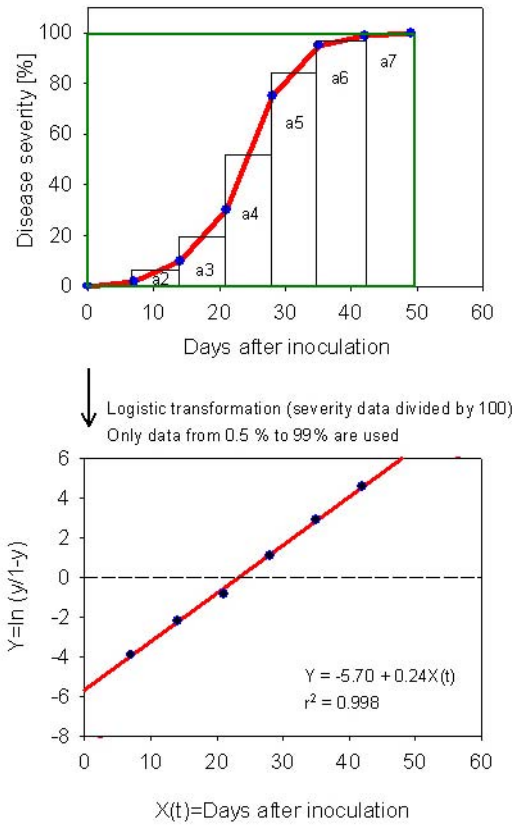
5.4 Show data – Field test for foliage blight

Show graphics

Year: 2005 Country: Denmark Region: Nordjylland Number of cultivars: 46 Number of dates: 14 Number of replicates: 3 Responsibilty: Poul Lassen

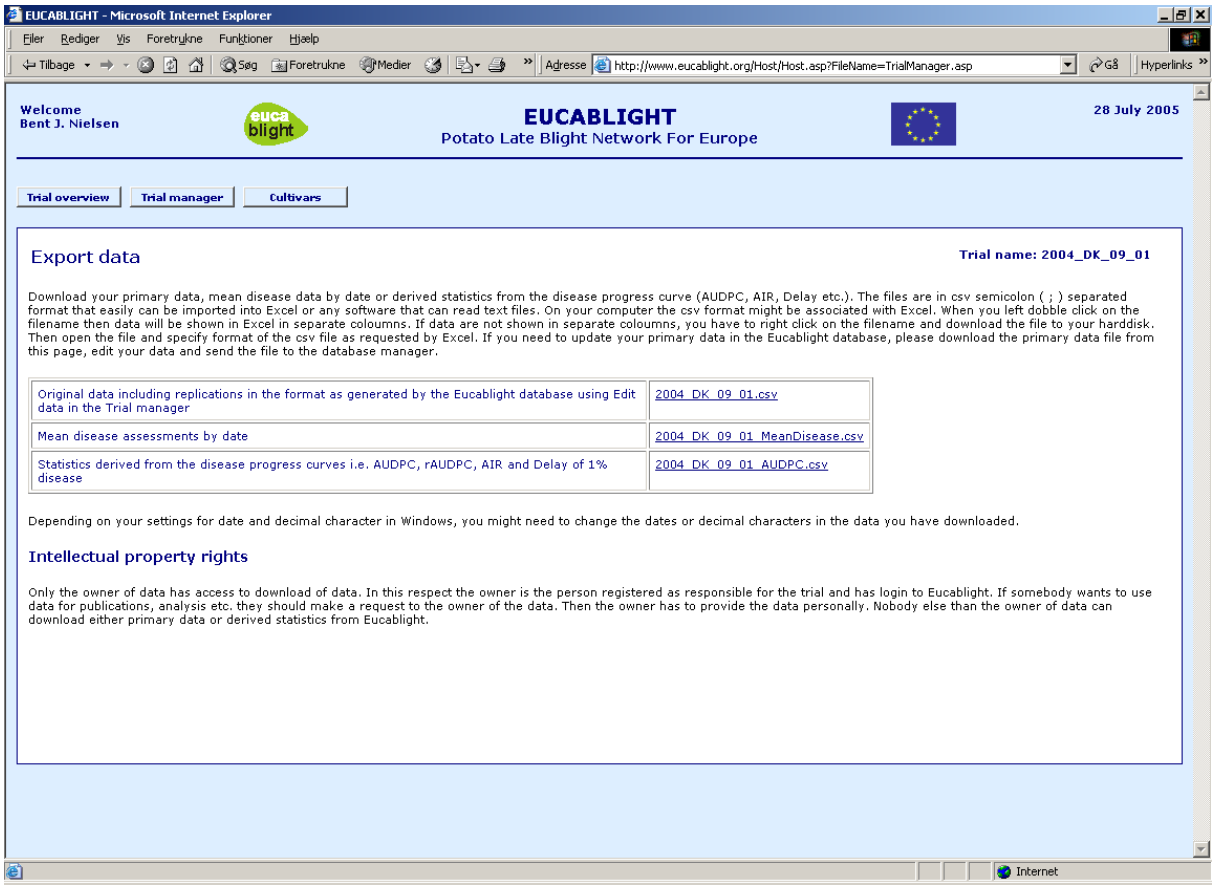
Cultivar/Genotype	AUDPC		RAUDPC		AIR (Logistic)		Goodness of fit (R^2)		AIR (Gompertz)		Goodness of fit (R^2)		Delay, 1% disease (days)		Delay, 5% disease (days)	
	mean	SE	mean	SE	mean	SE	min	max	mean	SE	min	max	mean	SE	mean	SE
Sarpo Mira	212,7	67,6	0,03	0,01	*	*	*	*	*	*	*	*	*	*	*	*
Kuras	1.705,1	42,8	0,25	0,01	0,15	0,01	0,94	0,98	0,09	0,00	0,89	0,97	19,4	1,5	30,7	1,3
Valiant	1.850,3	94,2	0,27	0,01	0,15	0,01	0,94	0,94	0,10	0,01	0,89	0,90	18,4	0,8	29,7	0,5
Mercury	2.403,2	181,5	0,35	0,03	0,21	0,01	0,95	0,97	0,15	0,01	0,89	0,92	22,4	1,7	30,2	1,6
Aviala	2.800,1	90,0	0,41	0,01	0,20	0,02	0,94	0,96	0,15	0,01	0,90	0,95	17,5	1,9	25,8	1,3
Kardent	2.831,5	98,8	0,41	0,01	0,19	0,01	0,90	0,97	0,13	0,01	0,86	0,95	16,6	1,7	25,1	1,4
Robijn	2.941,2	154,3	0,43	0,02	0,14	0,01	0,87	0,91	0,10	0,01	0,92	0,96	7,3	4,4	19,2	3,2
Canasta	3.037,4	22,2	0,44	0,00	0,24	0,01	0,92	0,96	0,16	0,01	0,89	0,96	19,4	0,7	26,3	0,5
Escort	3.318,4	110,4	0,48	0,02	0,35	0,04	0,94	0,98	0,23	0,02	0,89	0,96	22,2	3,2	27,1	2,5
Kardal	3.321,8	127,4	0,48	0,02	0,20	0,01	0,93	0,95	0,15	0,00	0,95	1,00	13,3	1,7	21,6	1,4
Bilbo	3.374,0	142,1	0,49	0,02	0,17	0,01	0,87	0,93	0,13	0,01	0,89	0,98	8,8	1,9	18,4	1,7
Producent	3.409,0	55,9	0,49	0,01	0,18	0,00	0,89	0,91	0,13	0,00	0,98	0,98	11,6	0,8	20,7	0,7
Tivoli	3.441,0	104,1	0,50	0,02	0,35	0,03	0,97	0,99	0,24	0,00	0,92	0,98	21,4	0,3	26,1	0,3
Starter	3.724,7	111,1	0,54	0,02	0,30	0,02	0,93	0,95	0,22	0,02	0,89	0,99	16,7	1,6	22,3	1,3

When you select Show Data in the Trial manager, it shows results derived from the disease progress curves. There will be a link to documentation of all methods applied to the data.



Calculation of AUDPC and logistic transformation for calculation of R (slope) and Delay of symptoms. Taken from the documentation file.

5.5 Export data – Filed test for foliage blight



Download your primary data, mean disease data by date or derived statistics from the disease progress curve (AUDPC, AIR, Delay etc.). The files are in csv semicolon (;) separated format that easily can be imported into Excel or any software that can read text files. On your computer the csv format might be associated with Excel. When you left double click on the filename then data will be shown in Excel in separate columns. If data are not shown in separate columns, you have to right click on the filename and download the file to your harddisk. Then open the file and specify format of the csv file as requested by Excel.

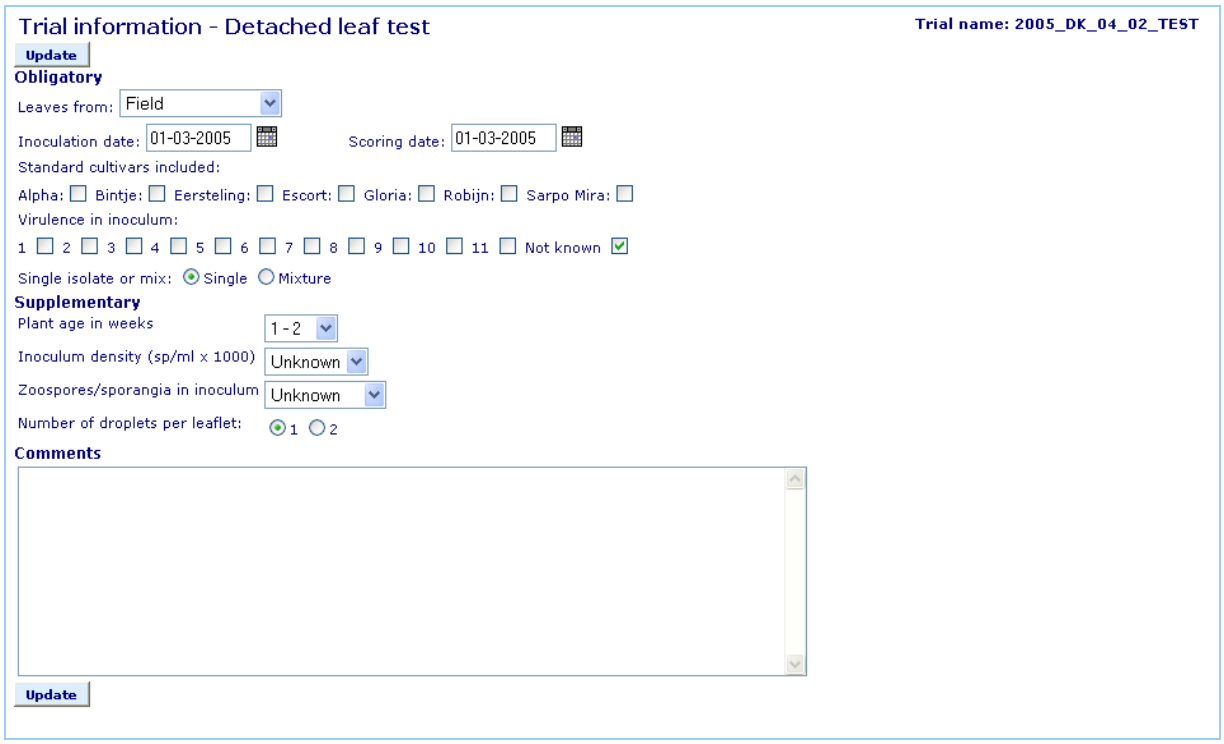
Only the owner of data has access to download of data. In this respect the owner is the person registered as responsible for the trial and has login to EUCABLIGHT. If somebody wants to use data for publications, analysis etc. they should make a request to the owner of the data. Then the owner has to provide the data personally. Nobody else than the owner of data can download either primary data or derived statistics from EUCABLIGHT.

5.6 Corrections of data after uploading

If you need to update your primary data in the EUCABLIGHT database, please download the primary data file from the Export data web page, edit your data and send the file to the database manager.

6 Detached leaf test for foliage blight resistance

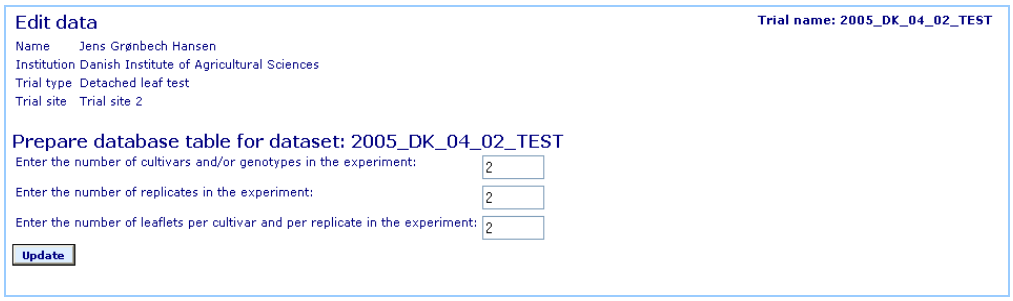
6.1 Edit Info – Detached leaf test for foliage blight resistance



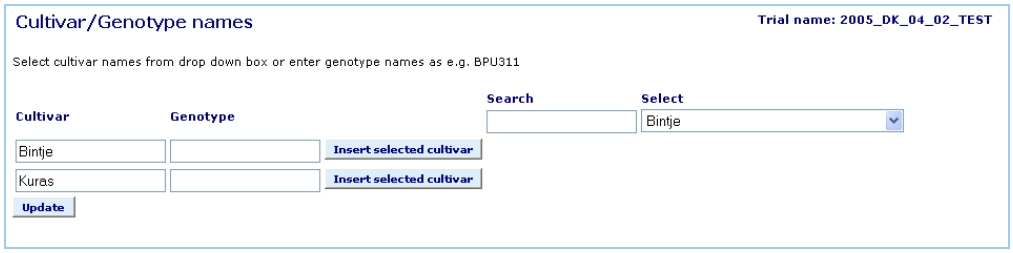
Fields and buttons	Explanation
Leaves from	Select via the drop down box if leaves were taken from the field, greenhouse or climate chamber.
Inoculation date	Press the calendar button and enter the date of inoculation.
Scoring date	Press the calendar button and enter the date of scoring for disease.
Standard cultivars included	Mark in the checkboxes which of the standard varieties were included in the trial.
Virulences in inoculum	Mark in the checkboxes which of the virulences are present in the inoculum.
Single isolate or mix	Mark if a single isolate or a mixture of isolates were used for inoculation.
Plant age in weeks	Select via the drop down box the age of the plants in weeks
Inoculum density	Select via the drop down box the density of inoculum (sporangia/ml x 1000)
Zoospores/sporangia in inoculum	Select via the drop down box if inoculum contains zoospores, sporangia or a mixture. Alternatively select Unknown.
Number of droplets per leaflet	Mark the number of droplets per leaflets used for inoculation.
Comment	Write additional information about the experiment in the comment text box.

6.2 Edit Data – Detached leaf test for foliage blight resistance

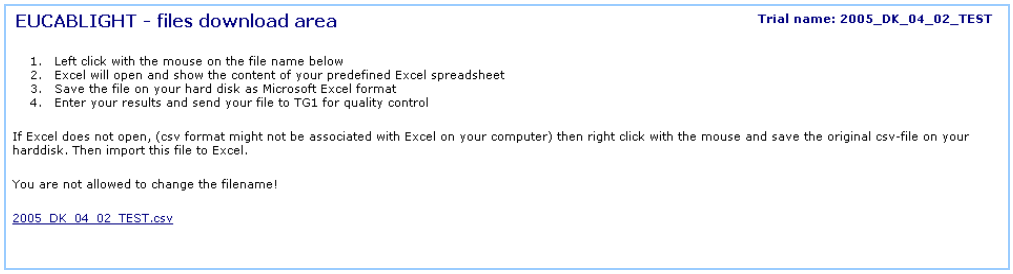
Step 1



Step 2



Step 3



Fields and buttons	Explanation
Step 1	When you select Edit data on the Trial manager main page, a new page opens for entrance of: 1. Number of varieties and/or genotypes in the trial/experiment 2. Number of replicates in the trial/experiment 3. Number of leaflets per cultivar and per replicate in the experiment This information is used for generation of the Excel spreadsheet for entrance of your primary data for disease assessments. When you have entered your numbers of varieties, replicates and dates, select Update to go to next step.
Step 2	Select cultivar names from the Select drop down box. To find a cultivar name among the 4000 names in the list you can search via the Search box. Write B, and the list will start at cultivar name Babanki. Write Bi, and the list will start with Biason. Scroll and find the correct name. If a variety in your trial is not in the list, then contact TG1, to include this in the list. For breeding line names write the code name directly in the text box for Genotype name.
Step 3	In the final step, the EUCABLIGHT database has now generated a csv file that you should use for entrance of your primary disease data. Right click with the mouse on the file name. If your default Windows separator is set to semicolon (;), then Excel will automatically open and read the file. Select Save as – change the file format to Excel – enter the file name as given on the files download area web page, and then save the file on your harddisk. If the file is not opened correctly, then save the csv file to your harddisk via left click on the file name. Then import the file to Excel and save as Excel format. Sort your original data according to the format in the EUCABLIGHT Excel file and copy and past your data into the EUCABLIGHT Excel spreadsheet. Finally, send this Excel with your data to the TG1 group for quality control. You will then be announced via an e-mail when your data have been uploaded to the database (Ok in Trial overview table).

6.3 Show Info – Detached leaf test for foliage blight resistance

Trial information [Name: 2005_DK_04_02_TEST] Print this page

Trial type	Detached leaf test
Trial responsible	Jens Grønbech Hansen
Trial institution	Danish Institute of Agricultural Sciences
Trial site	Trial site 2
Trial year	2005
Trial country	Denmark
Trial region	Århus

Obligatory

Leaves from:	Field
Inoculation date	08 June 2005
Scoring date	16 June 2005
Standard cultivars included	Alpha, Bintje, Eesterling, Escort
Virulence in inoculum	(1;2;5;8;10)
Single isolate or mix:	Single

Supplementary

Plant age in weeks	5 - 6
Inoculum density (sp/ml x 100)	10 - 20
Zoospores/sporangia in inoculum	Both, mixed
Number of droplets per leaflet:	2

Comments

When you select Show Info in the Trial manager, it shows all information you have entered via Edit Info.

6.4 Show data – Detached leaf test for foliage blight resistance

Trial data Trial name: 2005_DK_04_02_TEST

Plant stage, sporulation and Necrotic area, means per cultivar

Cultivar	Plant stage	Sporulation	Necrotic area
Bintje			
Kuras			

Screen dump currently not available

When you select Show data in the Trial Manger, it shows results derived from the disease scores on the 1-9 lesion size scale and the 1-3 sporulation scale. Lower averages indicate larger lesions and more sporulation.

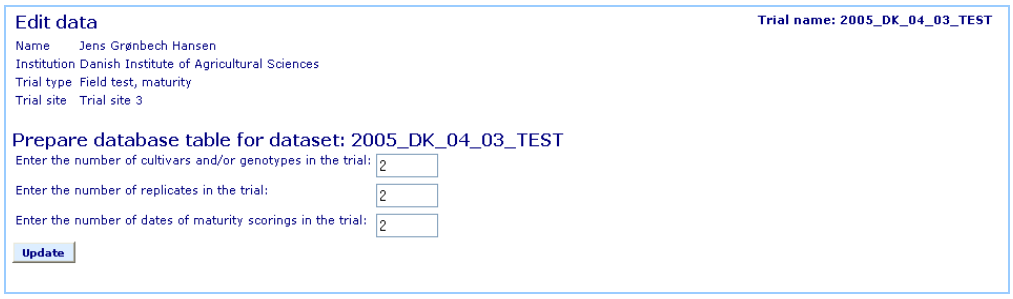
7 Field test for maturity

7.1 Edit Info – Field test for maturity

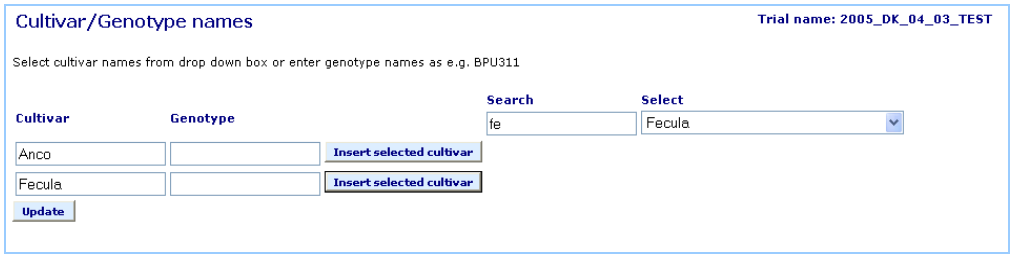
Fields and buttons	Explanation
Planting date	Press the calendar button and select the planting date of the potatoes.
Soil type	Select via drop down box the soil type in the trial.
N-fertilization	Select the total amount of N fertilization applied.
Amount of irrigation	Select the total amount of irrigation as close as possible to options available.
Standard cultivars Included	Mark in the checkboxes which of the standard cultivars that were included in the trial.
Frequency of irrigation	Select the frequency of irrigation. If irrigation was carried out only a few times (irregularly) then select Less as required.
Comment	Write additional information about the experiment in the comment text box.

7.2 Edit Data – Field test for maturity

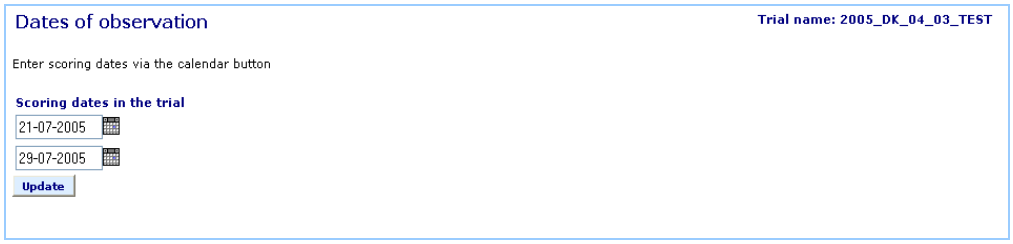
Step 1



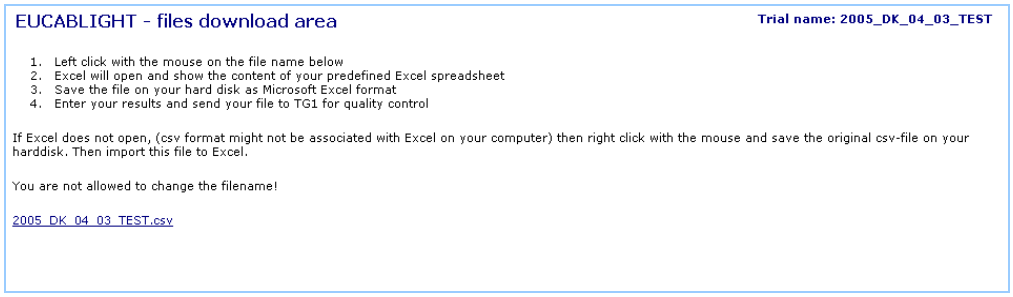
Step 2



Step 3



Step 4



Fields and buttons	Explanation
Step 1	When you select Edit data on the Trial manager main page, a new page opens for entrance of: 4. Number of varieties and/or genotypes in the trial/experiment 5. Number of replicates in the trial/experiment 6. Number of dates of maturity scorings in the trial/experiment This information is used for generation of the Excel spreadsheet for entrance of your primary data for disease assessments. When you have entered your numbers of varieties, replicates and dates, select Update to go to next step.
Step 2	Select cultivar names from the Select drop down box. To find a cultivar name among the 4000 names in the list you can search via the Search box. Write B, and the list will start at cultivar name Babanki. Write Bi, and the list will start with Biason. Scroll and find the correct name. If a variety in your trial is not in the list, then contact TG1, to include this in the list. For breeding line names write the code name directly in the text box for Genotype name
Step 3	Select the Calendar button and select the dates of observations in the trial. This information is used for generation of the Excel spreadsheet for entrance of your primary data for maturity scorings. Using the Calendar button, you can shift between years, ≤ < September 2005 > ≥, and between months < ≤ September 2005 ≥ >. Select Update to go to next step.
Step 4	In the final step, the EUCABLIGHT database has now generated a csv file that you should use for entrance of your primary disease data. Right click with the mouse on the file name. If your default Windows separator is set to semicolon (;), then Excel will automatically open and read the file. Select Save as – change the file format to Excel – enter the file name as given on the files download area web page, and then save the file on your harddisk. If the file is not opened correctly, then save the csv file to your harddisk via left click on the file name. Then import the file to Excel and save as Excel format. Sort your original data according to the format in the EUCABLIGHT Excel file and copy and past your data into the EUCABLIGHT Excel spreadsheet. Finally, send this Excel with your data to the TG1 group for quality control. You will then be announced via an e-mail when your data have been uploaded to the database (Ok in Trial overview table).

7.3 Show Info – Field test for maturity

Trial information [Name: 2005_DK_04_03_TEST]

Print this page

Trial type	Field test, maturity
Trial responsible	Jens Grønbech Hansen
Trial institution	Danish Institute of Agricultural Sciences
Trial site	Trial site 3
Trial year	2005
Trial country	Denmark
Trial region	Århus

Obligatory

Planting date	20 April 2005
Soil type	Sandy loam
N Fertilization	150 kg N/ha
Overhead irrigation amount	50-100 mm
Standard cultivars included	Alpha, Bintje, Eesterling, Escort, Gloria, Robijn

Supplementary

Overhead irrigation frequency	Weekly

Comments

No further comments

7.4 Show data – Field test for maturity

Trial data

Trial name: 2005_DK_04_03_TEST

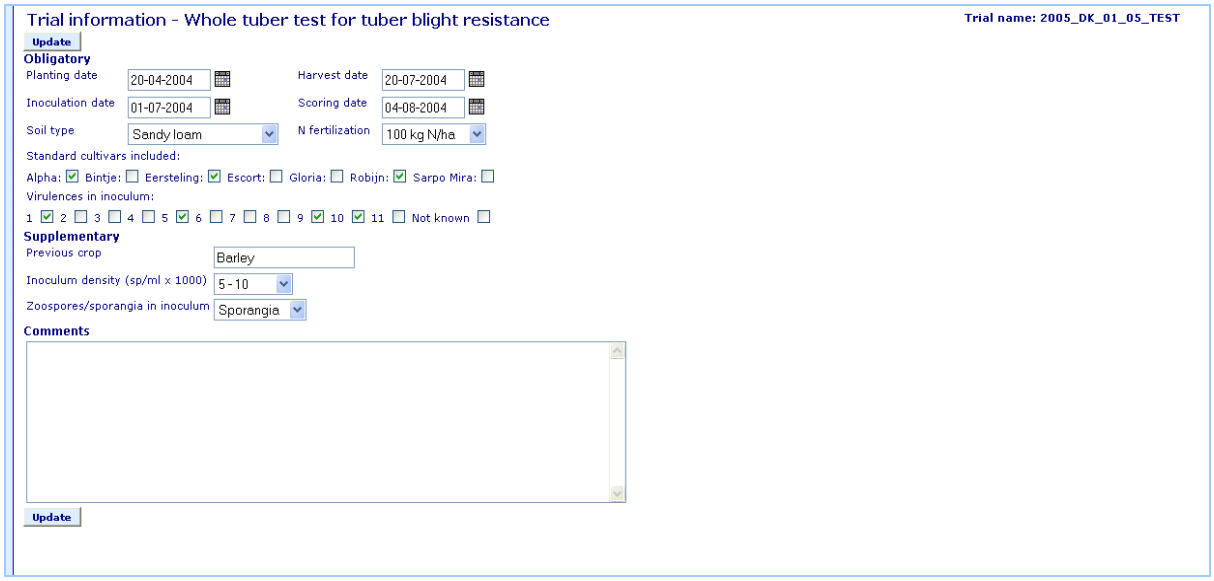
Maturity scoring [%], means per cultivar per date

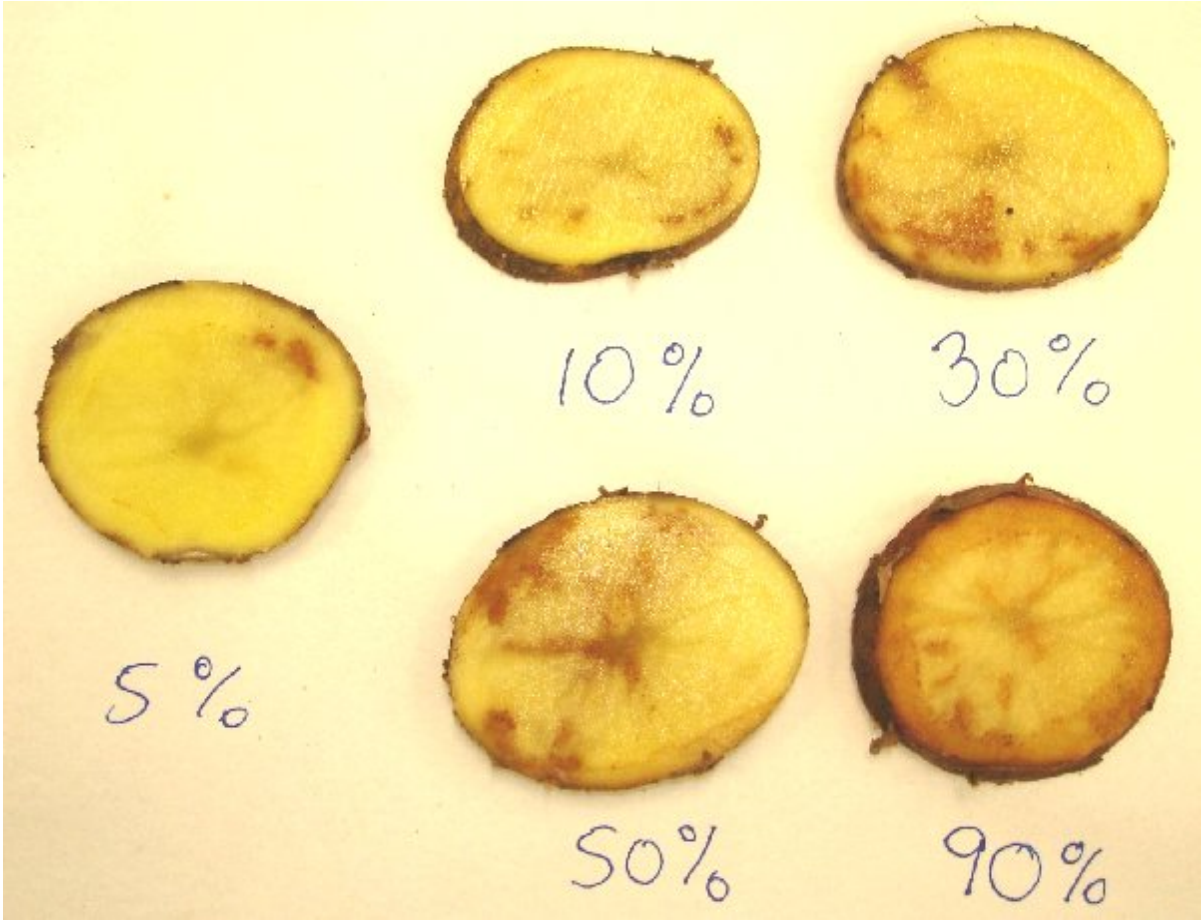
Cultivar	Date	
	21/7	29/7
Anco		
Fecula		

Maturity scores are used to estimate the number of days from planting until 95% maturation, by linear regression and extrapolation

8 Whole tuber test for tuber blight resistance

8.1 Edit Info – Whole tuber test for tuber blight resistance

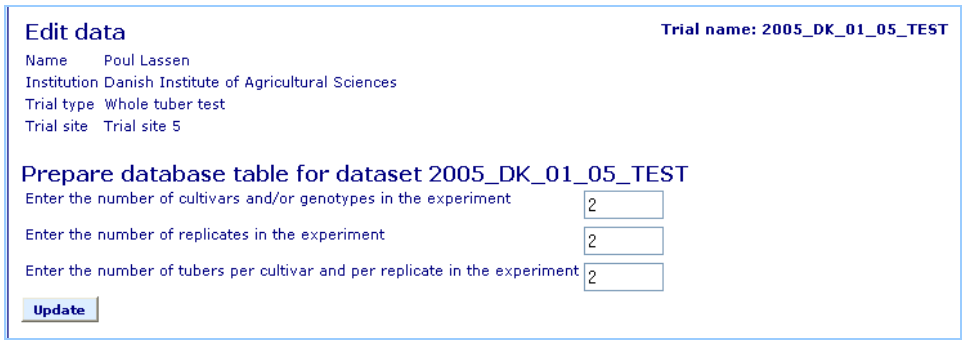




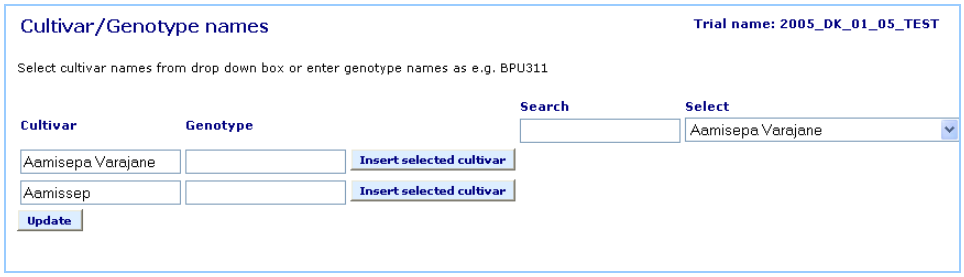
Fields and buttons	Explanation
Planting date	Press the calendar button and select the planting date of the potatoes.
Harvest date	Press the calendar button and select the harvest date of the potatoes.
Inoculation date	Press calendar button and select the date of inoculation of the tubers.
Scoring date	Press the calendar button and select the scoring date of the potatoes.
Soil type	Select via drop down box the soil type in the trial.
N-fertilization	Select the total amount of N fertilization applied.
Standard cultivars Included	Mark in the checkboxes which of the standard cultivars were included in the trial.
Previous crop	Write in the text box the name of the previous crop.
Inoculum density	Select the inoculum density used for inoculation.
Zoospores/sporangia in inoculum	Select the type of inoculum. If unknown then select Unknown.
Comments	Write comments about the trial i.e. use of fungicide, type etc., if a primary attack was observed (uneven disease development) or anything special.
Update	When you have entered all information, then select Update to store your information in the EUCABLIGHT database.

8.2 Edit Data – Whole tuber test for tuber blight resistance

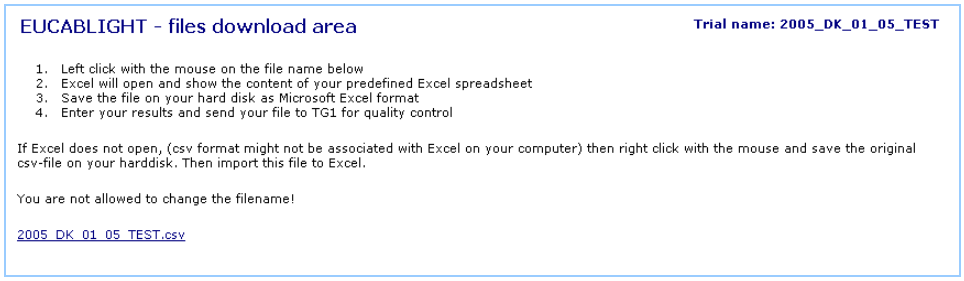
Step 1



Step 2



Step 3



Fields and buttons	Explanation
Step 1	When you select Edit data on the Trial manager main page, a new page opens for entrance of: 1. Number of varieties and/or genotypes in the trial/experiment: 2. Number of replicates in the trial/experiment: 3. Enter the number of tubers per cultivar and per replicate in the experiment This information is used for generation of the Excel spreadsheet for entrance of your primary data for tuber disease assessments. When you have entered your numbers of varieties, replicates and dates, select Update to go to next step.
Step 2	Select cultivar names from the Select drop down box. To find a cultivar name among the 4000 names in the list you can search via the Search box. Write B, and the list will start at cultivar name Babanki. Write Bi, and the list will start with Biason. Scroll and find the correct name. Some varieties may be hard to find, for example Mira is under S as Sarpo Mira and Timo is under H as Hankkijan Timo. If a variety in your trial is not in the list, then contact TG1, to include this in the list. For breeding line names write the code name directly in the text box for Genotype name.
Step 3	In the final step, the EUCABLIGHT database has now generated a csv file that you should use for entrance of your primary disease data. Right click with the mouse on the file name. If your default Windows separator is set to semicolon (;), then Excel will automatically open and read the file. Select Save as – change the file format to Excel – enter the file name as given on the files download area web page, and then save the file on your harddisk. If the file is not opened correctly, then save the csv file to your harddisk via left click on the file name. Then import the file to Excel and save as Excel format. Sort your original data according to the format in the EUCABLIGHT Excel file and copy and past your data into the EUCABLIGHT Excel spreadsheet. Finally, send this Excel with your data to the TG1 group for quality control. You will then be announced via e-mail when your data have been uploaded to the database (Ok in Trial overview table).

8.3 Show Info – Whole tuber test for tuber blight resistance

Trial information [Name: 2005_DK_01_05_TEST] Print this page

Trial type	Whole tuber test
Trial responsible	Poul Lassen
Trial institution	Danish Institute of Agricultural Sciences
Trial site	Trial site 5
Trial year	2005
Trial country	Denmark
Trial region	Nordjylland
Obligatory	
Planting date	20 April 2004
Harvest date	20 July 2004
Inoculation date	01 July 2004
Scoring date	04 August 2004
Soil type	Sandy loam
N Fertilization	100 kg N/ha
Standard cultivars included	Alpha, Eesterling, Robijn
Virulence in inoculum	(1;5;9;10)
Supplementary	
Previous crop	Barley
Inoculum density (sp/ml x 1000)	5 - 10
Zoospores/sporangia in inoculum	Sporangia
Comments	

Fields and buttons	Explanation
Show Info	When you select Show Info on the Trial Manager main page, the background information for your trial will be shown. You can always edit your background information.

8.4 Show data – Whole tuber test for tuber blight resistance

Screen dump currently not available.

Fields and buttons	Explanation
Show data	When you select Show Data on the Trial Manager main page, your primary data as mean per variety/genotype will be shown in a table

9 Tuber slice test for tuber blight resistance

9.1 Edit Info – Tuber slice test for foliage blight resistance

Trial information - Tuber slice test for tuber blight resistance

Trial name: 2005_DK_01_04_TEST

Update

Obligatory

Planting date 21-04-2004 Harvest date 03-08-2004

Inoculation date 15-07-2004 Scoring date 11-08-2004

Soil type Clay type, > 20 % clay N fertilization 150 kg N/ha

Standard cultivars included:

Alpha: ☑ Bintje: ☑ Eersteling: ☑ Escort: ☑ Gloria: ☑ Robijn: ☑ Sarpo Mira: ☑

Virulence in inoculum:

1 ☑ 2 ☑ 3 ☐ 4 ☑ 5 ☐ 6 ☑ 7 ☐ 8 ☐ 9 ☑ 10 ☑ 11 ☐ Not known ☐

Supplementary

Previous crop Wheat

Inoculum density (sp/ml x 1000) 5 - 10

Zoospores/sporangia in inoculum Sporangia

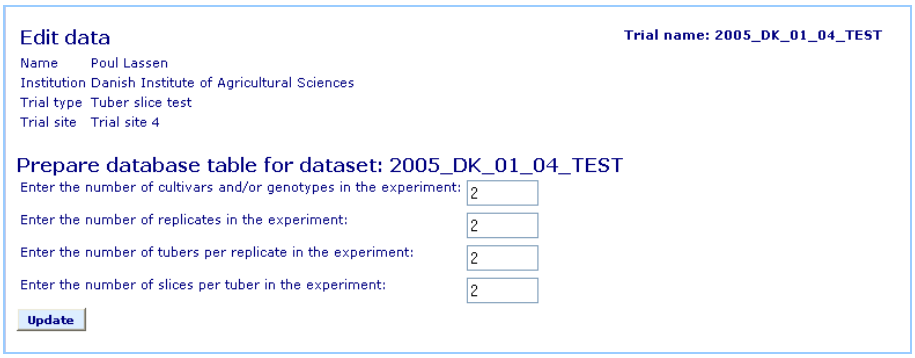
Comments

Update

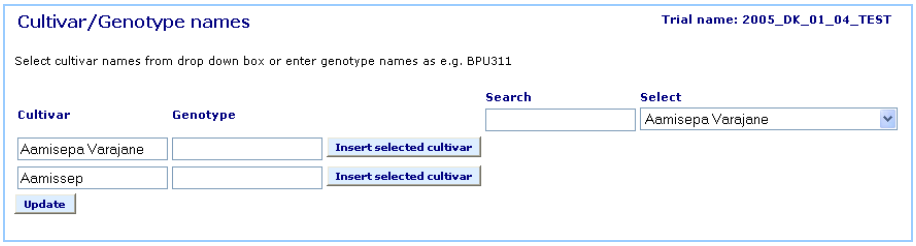
Fields and buttons	Explanation
Planting date	Press the calendar button and select the planting date of the potatoes.
Harvest date	Press the calendar button and select the harvest date of the potatoes.
Inoculation date	Press calendar button and select the date of inoculation of the tuber slices.
Scoring date	Press the calendar button and select the scoring date of the potatoes.
Soil type	Select via drop down box the soil type in the trial.
N-fertilization	Select the total amount of N fertilization applied.
Standard cultivars Included	Mark in the checkboxes which of the standard cultivars were included in the trial.
Previous crop	Write in the text box the name of the previous crop.
Inoculum density	Select the inoculum density used for inoculation.
Zoospores/sporangia in inoculum	Select the type of inoculum. If unknown then select Unknown.
Comments	Write comments about the trial i.e. use of fungicide, type etc., if a primary attack was observed (uneven disease development) or anything special.
Update	When you have entered all information, then select Update to store your information in the EUCABLIGHT database.

9.2 Edit Data – Tuber slice test for foliage blight resistance

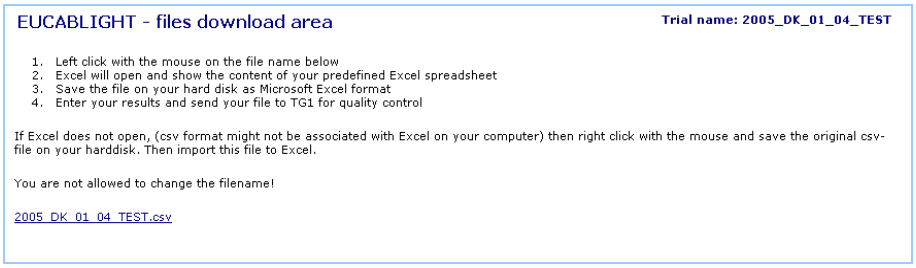
Step 1



Step 2



Step 3



Fields and buttons	Explanation
Step 1	When you select Edit data on the Trial manager main page, a new page opens for entrance of: 1. Number of varieties and/or genotypes in the trial/experiment: 2. Number of replicates in the trial/experiment: 3. Enter the number of tubers per replicate in the experiment: 4. Enter the number of slices per tuber in the experiment: This information is used for generation of the Excel spreadsheet for entrance of your primary data for tuber disease assessments. When you have entered your numbers of varieties, replicates and dates, select Update to go to next step.
Step 2	Select cultivar names from the Select drop down box. To find a cultivar name among the 4000 names in the list you can search via the Search box. Write B, and the list will start at cultivar name Babanki. Write Bi, and the list will start with Biason. Scroll and find the correct name. Some varieties may be hard to find, for example Mira is under S as Sarpo Mira and Timo is under H as Hankkijan Timo. If a variety in your trial is not in the list, then contact TG1, to include this in the list. For breeding line names write the code name directly in the text box for Genotype name.
Step 3	In the final step, the EUCABLIGHT database has now generated a csv file that you should use for entrance of your primary disease data. Right click with the mouse on the file name. If your default Windows separator is set to semicolon (;), then Excel will automatically open and read the file. Select Save as – change the file format to Excel – enter the file name as given on the files download area web page, and then save the file on your harddisk. If the file is not opened correctly, then save the csv file to your harddisk via left click on the file name. Then import the file to Excel and save as Excel format. Sort your original data according to the format in the EUCABLIGHT Excel file and copy and past your data into the EUCABLIGHT Excel spreadsheet. Finally, send this Excel with your data to the TG1 group for quality control. You will then be announced via e-mail when your data have been uploaded to the database (Ok in Trial overview table).

9.3 Show Info – Tuber slice test for foliage blight resistance

Screen dump not currently available.

Fields and buttons	Explanation
Show Info	When you select Show Info on the Trial Manager main page, the background information for your trial will be shown. You can always edit your background information.

9.4 Show data – Tuber slice test for foliage blight resistance

Screen dumps currently not available

10 Field test for tuber blight resistance

10.1 Edit Info – Field test for tuber blight resistance

Trial information - Field test for tuber blight resistance

Trial name: 2005_DK_01_06_TEST

Update

Obligatory

Early planting date 02-03-2005 Mid early planting date 02-03-2005 Late planting date 02-03-2005

Inoculation date 02-03-2005

Soil type Sand N fertilization 0 kg N/ha

Overhead irrigation:

Frequency No irrigation Total amount No irrigation

Standard cultivars included:

Alpha: ☐ Bintje: ☐ Eersteling: ☐ Escort: ☐ Gloria: ☐ Robijn: ☐ Sarpo Mira: ☐

Virulence in inoculum:

1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ Not known ☑

Supplementary

Late blight in the region 02-03-2005 Late blight at the trial site 02-03-2005

No late blight ☐ No late blight ☐

Early crop emergence date 01-01-2005 Mid early crop emergence date 01-01-2005 Late crop emergence date 01-01-2005

Previous crop

Inoculum density (sp/ml x 1000) Unknown

Zoospores/sporangia in inoculum Unknown

Organic: ◉ No ○ Yes

Comments

Update

Fields and buttons	Explanation
Early planting date	Press the calendar button and select the planting date of early potatoes.
Mid early planting date	Press the calendar button and select the planting date of mid early potatoes.
Late planting date	Press the calendar button and select the planting date of late potatoes.
Inoculation date	Press calendar button and select the date of artificial inoculation in the trial. If inoculum source was natural infection then select the date when first symptoms occurred in the trial.
Soil type	Select via drop down box the soil type in the trial.
N-fertilization	Select the total amount of N fertilization applied.
Frequency of irrigation	Select the frequency of irrigation. If irrigation was carried out only a few times (irregularly) then select Less as required.
Amount of irrigation	Select the total amount of irrigation as close as possible to options available.
Standard cultivars Included	Mark in the checkboxes which of the standard cultivars were included in the trial.
Late blight in the Region	Press the calendar button and select the date when late blight appeared in the region (5-10 square km radius). Alternatively mark No late blight.
Late blight in the trial	Press the calendar button and select the date when late blight appeared at the trial site. Alternatively mark No late blight.
Early Crop emergence	Press the calendar button and select the date of crop emergence for early potatoes.
Mid early Crop emergence	Press the calendar button and select the date of crop emergence for mid early potatoes.
Late Crop emergence	Press the calendar button and select the date of crop emergence for late potatoes.

Previous crop Write in the text box the name of the previous crop.

Inoculum density Select the inoculum density used for artificial inoculation. If natural infection then select <5 sp/ml x 1000.

Zoospores/sporangia in inoculum Select the type of inoculum. If unknown or natural infection then select Unknown.

Organic Select via radio button if the trial was grown organic or not.

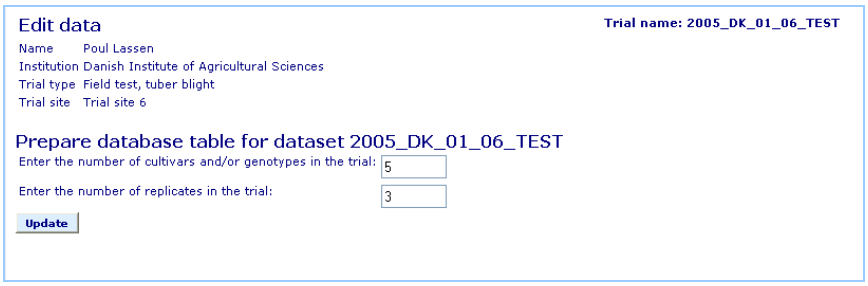
Comments Write comments about the trial i.e. use of fungicide, type etc., if a primary attack was observed (uneven disease development) or anything special.

Update

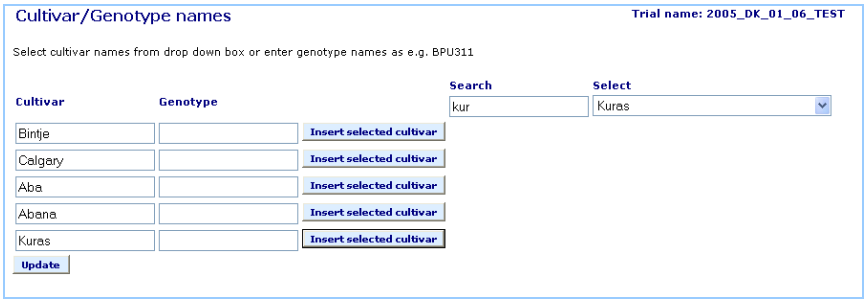
When you have entered all information, then select Update to store your information in the EUCABLIGHT database.

10.2 Edit Data – Field test for tuber blight resistance

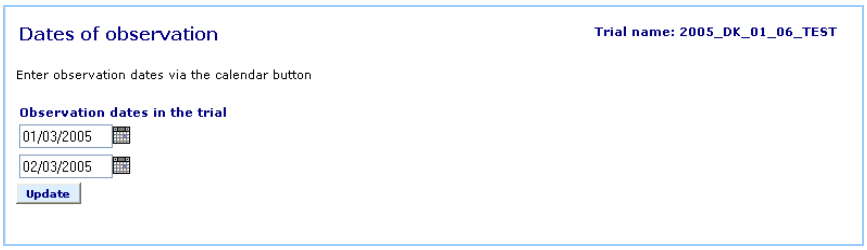
Step 1



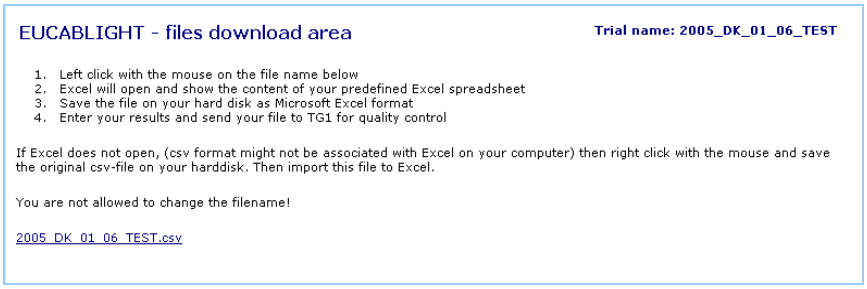
Step 2



Step 3



Step 4



Fields and buttons	Explanation
Step 1	When you select Edit data on the Trial manager main page, a new page opens for entrance of: • Number of varieties and/or genotypes in the trial/experiment • Number of replicates in the trial/experiment The number of scoring dates is fixed at 2 scoring dates as indicated in the protocol. This information is used for generation of the Excel spreadsheet for entrance of your primary data for disease assessments. When you have entered your numbers of varieties and replicates, select Update to go to next step.
Step 2	Select cultivar names from the Select drop down box. To find a cultivar name among the 4000 names in the list you can search via the Search box. Write B, and the list will start at cultivar name Babanki. Write Bi, and the list will start with Biason. Scroll and find the correct name. If a variety in your trial is not in the list, then contact TG1, to include this in the list. For breeding line names write the code name directly in the text box for Genotype name.
Step 3	Select the Calendar button and select the dates of observations in the trial. This information is used for generation of the Excel spreadsheet for entrance of your primary data for maturity scorings. Using the Calendar button, you can shift between years, ≤ < September 2005 > ≥, and between months < ≤ September 2005 ≥ >. Select Update to go to next step.
Step 4	In the final step, the EUCABLIGHT database has now generated a csv file that you should use for entrance of your primary disease data. Right click with the mouse on the file name. If your default Windows separator is set to semicolon (;), then Excel will automatically open and read the file. Select Save as – change the file format to Excel – enter the file name as given on the files download area web page, and then save the file on your harddisk. If the file is not opened correctly, then save the csv file to your harddisk via left click on the file name. Then import the file to Excel and save as Excel format. Sort your original data according to the format in the EUCABLIGHT Excel file and copy and past your data into the EUCABLIGHT Excel spreadsheet. Finally, send this Excel with your data to the TG1 group for quality control. You will then be announced via e-mail when your data have been uploaded to the database (Ok in Trial overview table).

10.3 Show Info – Field test for tuber blight resistance

Trial information [Name: 2005_DK_01_06_TEST]

Print this page

Trial type	TrialTypeName
Trial responsible	Poul Lassen
Trial institution	Danish Institute of Agricultural Sciences
Trial site	Trial site 6
Trial year	2005
Trial country	Denmark
Trial region	Nordjylland

Obligatory

Early planting date	02 March 2005
Mid early planting date	02 March 2005
Late planting date	02 March 2005
Inoculation date	02 March 2005
Soil type	Sand
N Fertilization	0 kg N/ha
Overhead irrigation frequency	No irrigation
Overhead irrigation total amount	No irrigation
Standard cultivars included	
Virulence in inoculum	Not known

Supplementary

Late blight in the region	02 March 2005
Late blight at the trial site	02 March 2005
Emergence date	02 March 2005
Previous crop	
Inoculum density (sp/ml x 1000)	Unknown
Zoospores/sporangia in inoculum	Unknown
Organic:	No

Comments

10.4 Show data – Field test for tuber blight resistance

Screen dump currently not available

11 References

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12 Host resistance database tables and diagram

The database field names and tables cover all trial types. Most of the database fields are identical between trial types but certain field names are only associated with a specific trial type i.e. PlantingDateEarly, PlantingDateMedium and PlantingDateLate is only for tuber field test. None of the database fields concerning inoculation with *P-i.* are included in maturity test. Each field name is associated with a trial type via the trial type ID number.

Table 1. hst_Trial. Database field names, explanation, field type, ID numbers and options of host resistance data in the EUCABLIGHT database. A combination of the four key variables results in a unique identification of the trial.

VARIABLES IN DATABASE (FIELD NAMES)		EXPLANATION	FIELD TYPE	ID NUMBERS AND OPTIONS
[Trial year]	Key variables	Trial year	Integer	-
[CountryID]		Country ID e.g. UK, NL	String [2]	-
[RegionID]		Region ID number	Integer	-
[TrialID]		Trial ID number	Integer	-
[TrialName]		Original name of isolate	String [50]	-
[TrialSite]		Public or not	String [50]	-
[TrialTypeID]		Name of the nearest town	Integer	-
[ResponsiblePersonID]		Name of the farm	String [3]	-
[PublicData]		Name of the field	Boolean	0. Public 1. Restricted
[PublicInfo]		Number ID of foci	Boolean	-
[NumberCultivar]		Number ID of plant	Integer	-
[NumberReplicate]		Leaf, tuber or stem number	Integer	-
[NumberDate]		Collection date	Datetime	-
[PlantingDate]		Owner of data.	Datetime	-
[InoculumDate]		UTM zone	Datetime	-
[SoilType]		UTM zone North	Integer	1. Sand 2. Loamy sand 3. Sandy loam 4. Clay type > 20%clay 5. Silt type > 40% silt 6. Peat 0. Unknown
[Nfertilisation]		UTM zone East	Integer	1. 0 kg N/ha 2. 50 kg N/ha 3. 100 kg N/ha 4. 150 kg N/Ha 5. 200 kg N/Ha 6. 250 kg N/Ha 7. >300 kg N/Ha

VARIABLES IN DATABASE (FIELD NAMES)	EXPLANATION	FIELD TYPE	ID NUMBERS AND OPTIONS
[IrrigationFrequency]	Latitude degree	Integer	1. No irrigation 2. Daily 3. Twice a week 4. Weekly 5. Less, as required
[LateBlightRegionDate]	Latitude second	Datetime	-
[LateBlightTrialDate]	Latitude North or South	Datetime	-
[EmergenceDate]	Longitude degree	Datetime	-
[PlantsPerPlot]	Longitude minute	Integer	1. 1 - 4 2. 5 - 9 3. 10-50 4. >50
[PreviousCrop]	Privious crop	String [50]	-
[InoculumSource]		Integer	1. Natural infection without spreader plants 2. Natural infection and spreader plants 3. Artificial infection and spreader plants
[InoculumTrialPart]		Integer	1. Whole trial 2. Plot 3. Plot leaflets 4. Spreaders 5. Infector plants
[InoculumDensity]		Integer	1. <5 sp/ml x 1000 2. 5 – 10 3. 10-20 4. 20-50 5. > 50
[IsolateComposition]		Integer	1. Zoospores 2. Sporangia 3. Both, mixed 0. Unknown
[LeafSource]		Integer	1. Field 2. Greenhouse
[IsolateType]		Integer	1. Single 2. Mixture
[PlantWeekAge]		Integer	1. 1-2 2. 3-5 3. 5-6 4. 7-8 5. 9-10
[Droplet]		Integer	1. 1 2. 2
[PlantingDateEarly]		Datetime	-
[PlantingDateMidEarly]		Datetime	-
[Planting DateLate]		Datetime	-
[Organic]		Integer	1. No 2. Yes
[HarvestDate]		Datetime	-

Table 2. hst_TrialType. Database field names, explanation, field type, ID numbers and options of host resistance data in the EUCABLIGHT database.

VARIABLES IN DATABASE (FIELD NAMES)		EXPLANATION	FIELD TYPE	ID NUMBERS AND OPTIONS
[TrialtypeID]	**Key**	Trial type ID	Integer	-
[TrialTypeName]		Name of the trial	String [50]	-

Table 3. hst_TrialVirulence. Database field names, explanation, field type, ID numbers and options of host resistance data in the EUCABLIGHT database.

VARIABLES IN DATABASE (FIELD NAMES)		EXPLANATION	FIELD TYPE	ID NUMBERS AND OPTIONS
[Trial year]	Key variables	Trial year	Integer	-
[CountryID]		Country ID e.g. UK, NL	String [2]	-
[RegionID]		Region ID number	Integer	-
[TrialID]		Trial ID number	Integer	-
[TrialVirulenceID]		Trial virulence ID	Integer	-
[TrialVirulenceTest]		Differentials included	Boolean	1. True 2. False
[TrialVirulenceValue]		Compatible test result	Boolean	1. True 2. False

Table 4. hst_TrialStandardCultivar. Database field names, explanation, field type, ID numbers and options of host resistance data in the EUCABLIGHT database.

VARIABLES IN DATABASE (FIELD NAMES)		EXPLANATION	FIELD TYPE	ID NUMBERS AND OPTIONS
[Trial year]	Key variables	Trial year	Integer	-
[CountryID]		Country ID e.g. UK, NL	String [2]	-
[RegionID]		Region ID number	Integer	-
[TrialID]		Trial ID number	Integer	-
[TrialStdCultivarID]		Standard cultivar ID	Integer	-
[TrialStdCultivarValue]		Standard cultivar included or not	Boolean	1. True 2. False

Table 5. hst_TrialCultivar. Database field names, explanation, field type, ID numbers and options of host resistance data in the EUCABLIGHT database.

VARIABLES IN DATABASE (FIELD NAMES)		EXPLANATION	FIELD TYPE	ID NUMBERS AND OPTIONS
[Trial year]	Key variables	Trial year	Integer	-
[CountryID]		Country ID e.g. UK, NL	String [2]	-
[RegionID]		Region ID number	Integer	-
[TrialID]		Trial ID number	Integer	-
[TrialCultivarID]		Standard cultivar ID	Integer	-
[TrialCultivarName]		Cultivar name	String [50]	-

Table 6. hst_TrialDate. Database field names, explanation, field type, ID numbers and options of host resistance data in the EUCABLIGHT database.

VARIABLES IN DATABASE (FIELD NAMES)		EXPLANATION	FIELD TYPE	ID NUMBERS AND OPTIONS
[Trial year]	Key variables	Trial year	Integer	-
[CountryID]		Country ID e.g. UK, NL	String [2]	-
[RegionID]		Region ID number	Integer	-
[TrialID]		Trial ID number	Integer	-
[TrialDateID]		Observation date ID	Integer	-
[TrialDate]		Observation Date	Datetime	-

Table 7. hst_TrialObservation. Database field names, explanation, field type, ID numbers and options of host resistance data in the EUCABLIGHT database.

VARIABLES IN DATABASE (FIELD NAMES)		EXPLANATION	FIELD TYPE	ID NUMBERS AND OPTIONS
[Trial year]	Key variables	Trial year	Integer	-
[CountryID]		Country ID e.g. UK, NL	String [2]	-
[RegionID]		Region ID number	Integer	-
[TrialID]		Trial ID number	Integer	-
[TrialCultivarID]		Standard cultivar ID	Integer	-
[TrialDateID]		Observation date ID	Integer	-
[TrialReplicateID]		Replicate ID	Integer	-
[TrialObservation]		Cultivar name	Float	-

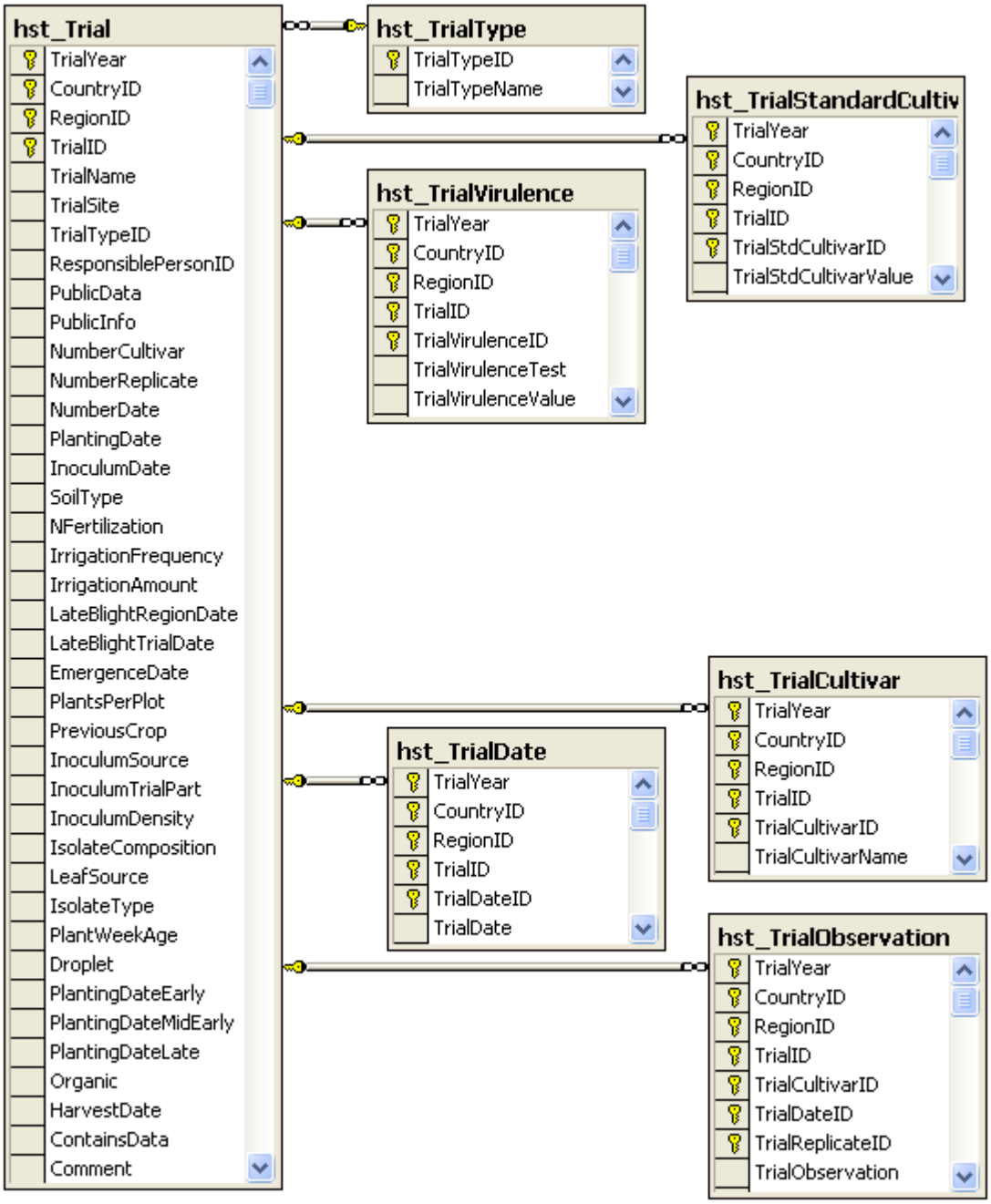

Figure 2. Host resistance database diagram of tables