



IPM Decisions

Deliverable 4.9

Catalogue of DSS collated with details on inputs, outputs and functionality

Grant agreement number: 817617

Start date of project: 01/06/2019

End date of project: 31/05/2024

Deliverable due date: 31/05/2020

Date of Delivery: 29/05/2020

Classification: Public

Version History

Version number	Implemented by	PME approval date	Reason
1.0	Lise Nistrup Jorgensen		Final version

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2 Summary

To design the IPM Decisions Platform and Dashboards, we need to know what IPM decision support systems (DSS) are available and their characteristics. Important characteristics include, for example, the types of input data the Platform needs to provide for a user to be able to run the DSS, and the types of maps, charts or tables which the Dashboards need to be able to provide for users to see the DSS output.

In total, information has been collected for 73 DSSs, which has been collated in the IPM Decisions DSS catalogue. This currently includes 40 DSSs covering diseases, 26 covering insects, 6 covering weeds, 2 covering slugs and 1 on potato haulm killing. Most of the systems are web based, but a few are installed and run on the user's computer, some of which are excel based. The majority of the systems require weather data input; temperature and rainfall data are the most common requirements. This deliverable provides an overview of prioritized DSSs; the full catalogue is available to all project partners. Development of this catalogue has taken place in parallel with making contact with DSS owners (through Work Package 6). The catalogue ensures that the project group is well informed about the DSS which are available and their characteristics. The discussions with DSS owners aim to find out which systems from the list will ultimately be fully or partially integrated with the Platform, or make use of resources from the Platform.

3 Introduction

The purpose of this deliverable is to provide an overview on DSSs used in the area of crop protection for crops in Europe. These systems have been developed to provide IPM support for growers, advisors and other end users. Our aim is to provide an updated and extended catalogue of DSSs partly building on the ENDURE catalogue of DSS (*Anon 2009, 2010*). The ambition has been to get as much relevant information about the systems as possible, including the need for agronomic background information, and technical requirements including demands for weather data. For several of the DSSs/models, more details on logic and mathematics, empirical evidence supporting the models and results from validation are to be found in the literature (References in section 9). Not all information about DSSs is freely available, particularly for commercialised systems. It is therefore not always been possible to collect all the information we desired without input from the DSS owners. A special section is included providing examples of input/outputs from a selected DSSs.

As a result of having the catalogue it has been possible to identify a priority list for the DSSs that we will seek to adopt on the platform (WP3).

To be considered relevant to our survey each DSS was required to include the following 4 elements:

1. evaluation of economic thresholds and/or recommendation of options for treatment
2. integration of various sources of information. Some 'added value' as compared to label and standard recommendation must be demonstrated.
3. use of decision algorithms and/or calculation models.
4. use of computers.



4 Working process for collection

A questionnaire was sent to all project partners in May 2019 asking for input on existing DSSs in use or developed in their country/region. Following the project kick-off meeting in Upsala July 2019, a list of suggestions for modification of the questionnaire was collected from the consortium as well as suggestions for additional questions. A modified version of the questionnaire, which was developed to provide sufficient input for partners in other work packages, was circulated for a second round of questions including elements listed in table 1 and 2. Based on all the collected information an Excel file with 73 DSSs has been generated. This is a 'live document' available to all project participants within the file share area, and it will continue to be updated throughout the project. To manage integration of the growing list of DSS in the catalogue, a prioritisation process has been initiated for implementation on the IPM Decisions platform.

Another activity has been initiated that focuses on generating a catalogue containing overviews of user interfaces and graphical outputs from the DSSs. Examples from this visual catalogue are presented in Section 7.

Table 1: Information requested on DSSs when building the catalogue

Information	Detail
Name of DSS and how to find it and contact people involved:	Module (if applicable); Link to web page; login required (yes/no); Username; Password; Instructions for locating the DSS on the page; E-mail address to contact person for the DSS; Owner of the DSS; Web page of DSS owner.
Input/ output	Target crop/pest; Type of decision; Type of DSS output; Model input data required; Weather data required; Frequency of weather data input; Spatial context of weather data; Historical or forecast weather data; Units of conversion for weather data.
Details about the quality of the DSS	Estimated number of users (by country); Price; Language of user interface; Format of models; Typical user; Are the underlying models documented, description of model published? Validated - area where developed, countries were tested? Provide links or literature references. Any features that you think make this decision support system special?

4.1 Summary of DSS catalogue format

Details of each DSS collected is kept in the DSS catalogue, using the table format with the headings laid out in Table 2.

Table 2. DSS Catalogue table of content.

Details
Name of respondent
Organisation of respondent
Country of respondent
Email of respondent
Name of decision support system
Module (if applicable)
Link to web page
login required
Username
Password
Instructions for locating the DSS on the page
E-mail address to contact person for the DSS
Owner of the DSS (institute, company,...)
Web page of DSS owner
Estimated number of users (by country)
Price
Language of user interface
Type of decision
Elaborations and comments
Type of DSS output
Elaborations and comments
Format of models
Typical user
Elaborations and comments
Model input data required
Elaborations and comments
Weather data required
Elaborations and comments
Frequency of weather data input
Elaborations and comments
Spatial context of weather data
Elaborations and comments
Historical or forecast weather data
Units of conversion for weather data
Are the underlying models documented? Provide links or literature references
Target crop/pest 1/2/3/4/5/6/7/8/9/10
Any features that you think make this decision support system special?



5 Overview of collected DSS

A list of the DSSs grouped by crop is listed in Table 3, which provides an overview of the systems available for each crop. In Tables 4, 5 and 6 further detailed information is listed for diseases, pests and weeds respectively.

Table 3. Information about number of DSSs covering different combinations of crop, disease, pest and weeds. Numbers in brackets gives the number of systems for the specific crop or target.

Crop types	Crops	Diseases	Pests	Weeds
Cereals (25)	Wheat (12)	Septoria tritici blotch (7), yellow rust (4), brown rust (4), Fusarium (3), DTR (4), powdery mildew (3), eyespot (2), leaf and glume blotch of wheat (2).	Aphids (2), barley gout fly, orange wheat gall midge, cereal leaf beetle, slugs.	Ryegrass
	Barley (7)	Net blotch (2), scald (2), powdery mildew, brown rust.	Aaphids, cereal leaf beetle.	Ryegrass
	Oats (3)	Powdery mildew, Fusarium head blight.	Aphids.	Ryegrass
	Rye	Brown rust, powdery mildew.	Wheat bulb fly.	Ryegrass
Potato (12)	Potato (12)	Late blight (10), Alternaria (4).	Potato moth, aphids.	
Oil seed rape (11)	Oil seed rape (11)	Sclerotinia (3), light leaf spot (2), Phoma (2) Alternaria.	Pollen beetle (2), turnip sawfly, cabbage seed weevil, rape flea beetle, aphids, slugs.	Ryegrass, Blackgrass, Chickweed
Beets (2)	beets/sugarbeets		Aphids, turnip moths.	
Vegetables(21)	Cabbage (7)	Light leaf spot.	Cabbage root fly (3), summer cabbage fly, cabbage moth, pollen beetle.	
	Carrot (5)		Carrot fly (3), European tarnished plant bug, turnip moth.	
	Celery (2)	Late blight of celery	Turnip moth.	
	Onion (2)	Downy mildew (2)		
	Legumes		Turnip moth.	Ryegrass
	Leek (2) Lettuce	Downy mildew		
Fruit and berries (13)	Apple (7)	Scab (3), fireblight, mildew, brown rot.	Codling moth (2), apple fruit moth, fly-speck, apple sawfly.	
	Strawberry (2), Cherry, pear, Grapes, raspberry.			
Ornamentals (3)	Tulips, lilies			
Grassland (2)	Grassland (2)			Wild oat, broad-leaved weeds, docks, thistle, barren brome.
All/several crops (5)	Arable crops			Weeds

Table 4. Information about all crops and target organisms covered by DSSs contained in the catalogue, which deal with **diseases**. See Table S1 for latin names and EPPO codes of targets.

Country	Name of decision support system	Crop	Target
Denmark	Crop Protection Online	Wheat Barley Rye Oat	Septoria tritici blotch, yellow rust, powdery mildew, brown rust. Net blotch, brown rust, powdery mildew, scald. Brown rust, powdery mildew. Powdery mildew.
	Humidity model	Wheat	Septoria tritici blotch.
	BlightManager	Potato	Late blight, early blight.
Sweden	<i>Lökbladmögel, MA-model</i>	Onion	Downy mildew.
Norway	VIPS, Apple Scab Model	Apple	Scab (2 models).
	VIPS, The Naerstad model	Potato	Late blight.
	VIPS, The Negative prognosis model	Potato	Late blight.
	VIPS, the Bremia lactucae model	Lettuce	Downy mildew.
	VIPS, DOWNCAST model	Allium	Downy mildew.
	VIPS, Septoria apiicola model	Celery	Celery late blight.
	VIPS, Model for leaf blotch disease complex in wheat	Summer Wheat	Leaf and glume blotch, septoria tritici blotch, tan spot.
	VIPS, Model for leaf blotch disease complex in wheat	Winter Wheat	Leaf and glume blotch, septoria tritici blotch, tan spot.
	VIPS, Model for scald in barley	Barley	Scald.
	VIPS, Model for barley net blotch	Barley	Netblotch.
	VIPS, Model for White Mold or Sclerotinia stem rot on rape seed	Oilseed rape/Rape seed	Sclerotinia stem rot.
	VIPS, Model for flowering of oats	Oats	Date of flowering, reduction of DON.
	Finland	Wisuprognose Wisuprognose Wisuprognose Wisuprognose	Barley Barley Wheat Wheat
DON risk in spring cereals		Spring oat, Spring barley, Spring wheat	Fusarium.
Netherlands	QMS Boomteelt	Ornamental	Several pests and diseases.
	Late blight app	Potato	Late blight.
	QMS fruitteelt/Rimpro	Apple	Apple scurf, brown spot, powdery mildew.
	Zietemanagement	Potato Strawberry,	Late blight, early blight.

		Sugar beet, Lily, Carrot, Leek, Tulip	
UK	CropMonitor Pro	Winter wheat	Septoria tritici blotch, powdery mildew, yellow rust, brown rust, fusarium, eyespot, tan spot, BYDV.
		Winter oilseed rape	Alternaria, light leaf spot, phoma leaf spot, Sclerotinia stem rot.
		Potatoes (incomplete)	Early blight, late blight.
		Barley (in development)	to be confirmed
	OSR Phoma forecast	Oilseed rape	Phoma leaf spot.
	OSR light leaf spot	Oilseed rape	Light leaf spot.
		Vegetable Brassicas	Light leaf spot.
	<i>OSR sclerotinia risk report</i>	Oilseed rape	Sclerotinia stem rot.
	<i>Fight Against Blight</i>	Potato	Late blight.
<i>Blightwatch</i>	Potato	Late blight.	
Mycotoxin risk tool	Wheat	DON/ZON.	
	Arable	Pests, diseases and weeds.	
Crop Protect App	OSR	Light leaf spot.	
Light leaf spot	OSR	Phoma leaf spot.	
Phoma forecast	OSR	Phoma leaf spot.	
Germany	ISIP	Wheat	Septoria tritici blotch, brown rust, tan spot, yellow rust, powdery mildew.
	<i>ISIP</i>	Potatoes	Late blight.
France	Optidose® and Optidose Pro®	Grapevine	Downy mildew, powdery mildew.
	Mileos®	Potato	Late blight.
	Optiprotect	Wheat	Eyespot, septoria tritici blotch, yellow rust, brown rust, fusarium head blight.
	Movida	Grapevine	Downy mildew, powdery mildew.
	MILART	Artichock	Downy mildew.
	RIMpro (Version Arbo)	Apple	Scab, fire blight, fly speck.
Greece	gaiasense	Pistachio	<i>Septoria</i> sp.
		Almonds	Brown rot blossom blight, leaf curl.
		Grapes	Downy mildew, powdery mildew.
		Legumes	Anthraco nose of bean, leaf blight of pea, leaf blight of bean, rust of bean.
		Olives	Leaf spot.
Peaches	Brown rot, leaf curl, shot-hole, powdery mildew.		
Potato	Alternaria blight.		



Table 5. Information about all crops and target organisms covered by DSSs contained in the catalogue, which deal with insect **pests**. See Table S2 for latin names and EPPO codes of targets.

Country	Name of decision support system	Crop	Target
Denmark	Crop Protection Online	Wheat	Aphids, cereal leaf beetle.
		Barley	Aphids, cereal leaf beetle.
		Oat	Aphids.
	<i>Degree day model for Chlorops pumilionis</i>	Spring wheat	Barley gout fly.
Norway	Forecasting of turnip moths and carrot flies	Carrots, beets, parsnips, celery and leeks Carrots	Turnip moths. Carrot flies.
	VIPS, Codling moth	Apple	Codling moth.
	VIPS, Apple fruit moth	Apple	Apple fruit moth.
	VIPS, Cabbage maggot - flight period	Cabbage	Cabbage root fly.
	VIPS, Cabbage maggot and turnip fly	Cabbage	Cabbage root fly, turnip root fly.
	VIPS, Cabbage moth model	Cabbage	Cabbage moth.
	VIPS, Carrot rust fly observation model	Carrots	Carrot fly.
	VIPS, Carrot rust fly temperature model	Carrots	Carrot fly.
VIPS, European tarnished plant bug model	Vegetables	European tarnished plant bug.	
Finland	Cabbage root fly	cabbage	Cabbage root fly.
Netherlands	QMS Boomteelt	Ornamental crops	Several pests.
	QMS fruitteelt/Rimpro	Apple	Codling moth, apple sawfly.
UK	CropMonitor Pro	Winter wheat	BYDV, grain aphid, rose-grain aphid, orange wheat blossom midge, slugs.
		Winter oilseed rape	Aphid vectors of TuYV, Cabbage seed weevil, cabbage stem flea beetle, mealy cabbage aphid, pollen beetle, slugs, turnip sawfly.
	Potato aphid monitoring	Potato	Peach-potato aphid.
	Pollen beetle in oilseed rape	Oilseed rape	Pollen beetle.
		Vegetable brassicas	Pollen beetle.
	Crop Protect App	Arable	Several pests.
	Wheat bulb fly	Cereals	Wheat bulb fly.
	Carrot fly	Carrots, Celery, Celeriac, Parsnips, Parsley	Carrot fly.
Cabbage root fly	Crucifers	Cabbage root fly.	

	Aphid degree days	<i>Ribes</i> spp. Lettuce Carrots, Dill, Parsley, Celery, Fennel	Currant- lettuce aphid. Lettuce root aphid. Willow-carrot aphid.
	Large narcissus fly	<i>Narcissus</i> <i>Amaryllis</i>	Large narcissus fly. Large narcissus fly.
	Rothamsted Insect Survey annual forecast for 6 species and 14 traps with weekly reports of actual counts	Cereals, bird cherry Cereals Rose, cereals. Flowers, fruits and vegetables. Potato, tomato, aubergine, lettuce, maize, sugarbeet, lettuce, roses. Crucifers	Bird cherry–oat aphid. Grain aphid. Rose–grain aphid. Peach—potato aphid. Potato aphid. Cabbage aphid.
Greece	gaiasense	Almonds	Almond wasp.
		Grapes	European grapevine moth.
		Peaches	Peach worm, summer fruit tortrix, peach tip moth.
		Potatoes	Potato moth.

Table 6. Information about all crops and **weeds** targeted by DSSs contained in the catalogue. See Table S3 for latin names and EPPO codes of targets.

Country	Name of decision support system	Crop	Target
Denmark	DK-RIM	Winter cereals, spring cereals, oilseed rape, legumes.	Ryegrass. versions on blackgrass and rat's-tail fescue is being developed.
	Crop Protection Online - Weeds	32 crops	>90 weed species.
	IPMwise	31 field crops	105 weed species.
UK	Corteva Grassland App	Grassland	Broad-leaved weeds, dock thistle.
	Kerb weather tool	Oilseed rape Annual meadow-grass	Blackgrass, chickweed. Wild-oat, barren brome.
	WeedManager	Arable	Weeds in a rotation.
	Crop Protect App	Arable	Pests, diseases and weeds.
Netherlands	Haulm killing ware or starch potatoes	potatoes, variable dose rate based on crop biomass	Haulm killing.
	Appsforagri	All crops	
	GEWIS (and in addition Crop Alert, disease management in 13 different crops, arable, vegetable, flowerbulbs)	All crops	
	Waarschuwingen	Apple, pear, strawberry, raspberry, cherries, grapes	



6 Detailed description of prioritised DSS's

In the following section DSSs which currently have been prioritized to be included on the DSS platform (WP3) are described in more details. Note that being prioritized for inclusion does not imply that there is agreement yet with the DSS owner for integration with the Platform. Table 7 provides a short overview on input requirements from some of the prioritized DSSs. Following this a more detailed description of available systems are provided on target organisms. As each systems is somewhat unique the information is not consistent across all systems. Examples of input and output requirements are given in section 7.

The reference list include options for getting more detailed information on the specific DSSs.

Table 7. Overview of types of input required from DSSs covering some of the key diseases, pests and weeds which are represented in the catalogue of DSSs.

Key targets	Crop	No. of DSS	Zone N,C,S	Input requirements
Diseases				
Septoria	Wheat	6	N,C,S	Weather, field observations, growth stage, crop variety, date of sowing, pre crop. Other: tillage. Optional input: fungicide application, disease severity (on 4 leaves of 25 plants).
Potato late blight	Potato	10	N,C,S	Weather, Other: Date of 50% germination, weather, field observations, pre crop, date of sowing, growth stage, crop variety, tillage, soil type, Field samples.
Apple scab	Apple	3	N,C,S	Weather, crop variety, field observations, growth stage, other: Biofix - date. Model starts based on growth stage, i.e. green tip in early flowering cultivars
Insects				
Aphids	Several	6	N,C	Weather, field observations, growth stage, crop variety, pre-crop, date of sowing, tillage, soil type, Suction trap aphid data, aphid counts, yellow water trap data.
Cabbage root fly	Crucifers	3	N,C	Weather, date of sowing, growth stage, field observations: egg counts.
Carrot root fly	Carrots, celeriac, celery, parsnips, parsley	3	N,C	Field observations only (sticky traps), weather.
Weeds				
Weeds	Several	6	N,C	Field observations, costs of input and efficacy of herbicides and management, growth stage, weather, Crop name, under sown crop, weed species + sizes + numbers, kill rate, resistance tactics, herbicides on stock



6.1 Septoria tritici blotch in wheat

In the survey, six DSSs included risk evaluations for Septoria tritici blotch. High priority is given to this disease as it causes relative high yield-loss and requires relatively high input of fungicides across a large crop area. The disease is greatly affected by rainfall and humidity, and as a result all Septoria models require input on weather data, using either daily or hourly data. Rain data are particularly important as the spores of this pathogen are dispersed mainly by water splashes, which is also reflected by the fact that all Septoria DSSs in the catalogue require data on rain. Furthermore, data on %RH, leaf wetness, temperature, wind and solar radiation are required by some, but not all, of the Septoria DSSs.

The DSSs are active from end of tillering to early grain filling, after which, fungicide treatments are no longer possible. Given the importance of this disease, all six DSSs on Septoria have been given high priority for inclusion on the platform (Table 8). A short description of the special features of each system follows:

CPO is one of the few systems, which integrates different target diseases and pests into the same DSS. The Danish version includes pesticide recommendations. This does not apply to countries with other pesticides on the market. Cultivar susceptibility is an important element of the system. A special module has been developed for the SPOT-IT project to include a generic ranking of susceptibility. The system requires input from users based on field assessments (growth stages and frequency of plants attacked) as well as information on days of precipitation.

The humidity septoria model is an open source system developed in Denmark and tested in the Nordic- Baltic region in the SPOT-IT project. It is already implemented in VIPS. The model uses detailed weather data input as basis for recommendations. This include hourly information in %RH, precipitation and leaf wetness. A continuum of 20 hours with high humidity provides a risk period, in which STB can be expected to spread and infect.

VIPS, leaf blotch complex from Norway uses an Open Source technology platform for prognosis, monitoring and decision support in agriculture. The specific leaf blotch model has not been described in detail. VIPS is one of few systems which integrates different crops and target pests into the same DSS. The system can serve research, development and extension. Furthermore, VIPS is easily customized for international use, and can serve as a tool for research collaboration and model development.

Optiprotect is a French Septoria model. It provides a dashboard to follow evolution of disease risk with weather data updated each day. It includes a message and email function to give some advice to farmers and a personal advisory service from advisors to farmers.

CropMonitor Pro is a British system, with a Septoria module. The system is validated based on extensive UK datasets, making the system reliable for giving robust advice. The system provides rather detailed advice at field-level. It gives risk evaluations and recommendations on timing and product. Furthermore, the system covers a diversity of crops, pests and diseases.

ISIP is a German system, which uses detailed weather data to indicate risk of a number of different diseases in wheat. The system also takes the susceptibility of specific varieties into account, giving customised output for the cultivar in question.

Table 8. List of DSSs on Septoria prioritized for inclusion on the platform.

DSS name	CPO	Humidity model	VIPS, leaf blotch complex	Opti-protect	CropMonitor Pro	ISIP
DSS is covering more diseases	yes	no	Yes	Yes	yes	YES
Additional diseases covered	YR/BR/PM*		TS/SN*	YR/BR/ES*	YR/BR/PM/TS/ES*	BR, DTR, YR, PM*
Requires information on cultivar	yes	no	yes	Yes	yes	no
Requires monitoring data	yes	no	yes	No	yes	no
Requires input on GS	yes	no	no	Yes	yes	no
Requires weather data	yes	yes	yes	Yes	yes	yes
Requires weather data from system	yes	yes	yes	yes		yes
Requires weather data from user	yes	no	no	yes		no
DSS gives input on fungicides	yes	yes	no	No	yes	no
DSS is free	no	yes	yes	Partly	partly	partly
Available in English	yes	yes	no	No	yes	no
Are the underlying models documented?	yes	yes	yes	Yes	Not published	yes
Known to be validated	yes	yes		yes	Not public	
Description of model published				yes	no	
Developed since	1990	2015		2017	2020	
Typically used by farmers	yes	yes	yes	Yes	New models	yes
Typically used by advisors	yes	yes	yes	no	New models	yes
Country of respondent	Denmark	Denmark	Norway	France	UK	Germany
Area where developed	Denmark	Denmark		France	UK	
Owned by	SEGES/AU	free	NIBIO	Arvalis/APCA	CHAP/Fera	ZEPP
Countries where tested	DK, N, S, Baltic	DK, N, S, Baltic		France	UK	

6.2 Late blight

In the survey, 12 DSSs included diseases in potato. Some of these 12 DSS included different diseases on potato, however, initial focus is on potato late blight. Ten of the 12 DSS's have focused on potato late blight and four on Alternaria early blight. Both diseases can cause high losses of yield and require high input of fungicides. The majority of the identified DSSs for potato late blight use meteorological data to calculate infection periods and subsequent risk of epidemic progress. These calculations are used as a basis for recommending the timing of the first fungicide application and often to predict subsequent need for fungicide application. Some DSSs make recommendations on specific dates of the first fungicide treatment and subsequent risk throughout the season. There are many systems for late blight control. Some of the DSSs prioritized for inclusion on the platform are described in the following (Table 9).



Table 9. List of DSSs on potato late blight prioritized for inclusion on the platform.

DSS name	VIPS, The Naerstad model	CropMonitor Pro	Late blight app	Ziekte managment	Fight Against Blight	Blight watch	VIPS, The Negative prognosis model	Mileos®	ISIP, potato late blight	BlightManager
DSS is covering more diseases	no	yes	no	yes	no	no	no	no	no	yes
Additional diseases covered	no	Early blight	no	Early blight	no	no	no	no	no	Early blight
Requires information on cultivar	no	yes	yes	yes	no	no	no	yes	yes	yes
Requires monitoring data	no	yes	yes	yes	yes	no	no	yes	no	yes
Requires input on GS	no	yes	yes	yes	no	no	no	yes	no	yes
Requires weather data	yes	yes	yes	yes	no	yes	yes	yes	yes	yes
Requires weather data from user	no		no		no	no	no	yes	no	no
Requires weather data from system	yes		yes		no	yes	yes	yes	yes	yes
DSS gives input on fungicides	no	yes	yes	no	no	no	no	no	no	yes
DSS is free	Intermediate	intermediate	no	no	yes	no	intermediate	no	Intermediate	no
Available in English	yes	yes	no	yes	yes	yes	yes	no	no	yes
Underlying models documented?	manuscript in writing		yes	yes	?	?	yes	yes	yes	yes
Known to be validated			yes	yes				yes		yes
Description of model published			yes	no				yes	yes	yes
Developed since			2015	1990	2010			2009		
Typically used by farmers	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Typically used by advisors	yes	yes	yes	yes	yes	yes	yes	no	yes	yes
Country of respondent	Norway	UK	NL	NL	UK	UK	Norway	France	Germany	Denmark
area where developed			NL	NL				France	Germany	Denmark
Owned by	NIBIO	CHAP/Fera	Wageningen Research	Dacom / agrovision	AHDB	AHDB/101Smart Ltd	NIBIO	ARVALIS	ZEPP	AU
Countries were tested			NL, and Euroblight	Many in/outside EU				W EU, Quebec, BE, TN, CH		

BlightManager/Euroblight is a DSS based on the 'NegFry' model, supports decisions such as timing of first and subsequent fungicide applications, including fungicide compound and dose rate. This systems integrates potato late blight and early blight control. A goal for future development is to develop sub-models to integrate biological control agents and plant resistance inducers.

Late blight app from The Netherlands is based on recent research that accounts for an aggressiveness of the different strains of the disease.

Fight Against Blight enables growers to understand when Potato late blight is in their area via an online dashboard. Furthermore, research by AHDB into blight populations is utilised to enable farmers and advisors to monitor the genotypes appearing in their region.

Mileos® is a French DSS. In 2018 it was reported that 95% of its users were satisfied with it. The system has been described as “convenient”, “precise”, “highly responsive” and “user friendly” by farmers. The system is available via a smartphone app, making it convenient.

ISIP, late blight is a German system, which takes the susceptibility of cultivars into account when evaluating the current local risk of infection. Furthermore, infestation surveys provide information on where in the country infection has occurred and a map gives an overview of areas with risk of infection.

6.3 Grape diseases

Grape is a major crop in central and southern Europe. Several major diseases create problems and often fungicides are intensively applied. The systems are summarized in Table 10.

Gaiasense is a Smart Farming solution customised for smallholders in Greece that own small and fragmented land. It requires zero investment in equipment and uses agronomists as part of the solution. There is no generic model for all the country. The models are customized in each area to match the needs of the specific micro-climate and soil zones.

The models are fed with data from a variety of sources, including IoT stations with soil and atmospheric sensors, satellite data, field observations etc.

Movida® is a French system owned by Bayer. The system assesses the risk of downy mildew and powdery mildew to facilitate optimal application timing at field level. The software relies on several modules, including an epidemiological model on powdery mildew and downy mildew, a treatment program, which accounts for use of products relying a database of pesticides and biocontrol options, and a vine growth model. Real-time weather data is fed to the system from weather station across all wine growing regions in France. It is also possible for users to connect their own weather station to the system. Movida has been reported to reduce the Treatment Frequency Index by 27%, and has been stated to be satisfactory by 87% of its users (source: Bayer 2019 study).

Optidose®/Optidose Pro® is a French DSS, which provides a dose adjustment based on epidemiological models, the phenological stage of the vine and its vegetative development. More than 90 % of 932 users surveyed were reported to be satisfied by it (<https://www.vignevin-epicure.com>).



Table 10. List of DSSs on grape diseases prioritized for inclusion on the platform.

DSS name	gaiasense	Movida	Optidose® and Optidose Pro®
DSS is covering more diseases	yes	Yes	yes
Additional diseases covered	many on other crops	PM/DM	no
DSS requires information on cultivar	no	?	no
DSS requires monitoring data	yes	?	yes
DSS requires input on GS (from user/system)	yes	?	no
DSS requires weather data	yes	?	no
DSS gives input on fungicides	no	?	no
DSS is free	no	No	yes
Available in English	yes	No	no
Are the underlying models documented?	yes	?	yes
Known to be validated			yes
Developed since			2002
Typically used by farmer	yes	Yes	yes
Typically used by advisor	yes	Yes	yes
Country of respondent	Greece	France	France
Owned by	Neuropublic SA	Bayer	France

6.4 Sclerotinia stem rot on oilseed rape

Sclerotinia stem rot is one of the major yield reducing diseases in oil seed rape. Inoculum can build up in the soil over years and specific risk in a given season depends on weather conditions during flowering. Historically, it has often been seen as a major challenge to know whether there is a risk for this disease or not, systems are listed in table 11.

Table 11. List of DSSs on Sclerotinia stem rot prioritized for inclusion on the platform.

DSS name	CropMonitor Pro	OSR sclerotinia risk report	VIPS, Model for Sclerotinia stem rot
DSS is covering more diseases	yes	no	yes
DSS requires information on cultivar	yes	no	yes
DSS requires monitoring data	yes	yes	yes
DSS requires input on GS (from user/system)	yes	no	yes
DSS requires weather data	yes	yes	yes
DSS requires weather data from user		no	yes
DSS requires weather data from system		yes	no
DSS gives input on fungicides	yes	no	no
DSS is free	intermediate	yes	intermediate
Available in English	yes	yes	no
Are the underlying models documented?	Not published	yes	yes
known to be validated		yes	
description of model published		yes	
developed since		2003	
Typically used by farmers	yes	yes	yes
Typically used by advisors	yes	yes	yes
Country of respondent	UK	UK	Norway
area where developed		UK	
own by	CHAP/Fera	AHDB	NIBIO
countries were tested		UK	

OSR sclerotinia risk report is a simple UK system. It is user friendly system with an online dashboard and enables growers to decide not to spray based on data collected from a large amount of weather stations. Observed and forecast weather data on RH and air temperature are used as basis for risk warnings, which are activated when thresholds of 80% relative humidity and 7°C are exceeded. Furthermore, information on spore loading is also used to assess current risk of infection.

CropMonitor Pro and VIPS see section 6.1 on Septoria.

6.5 Apple scab

Apple scab is the most important disease on apples. Despite the fact it does not greatly affect yield, this disease causes economic losses by affecting crop quality. Since even minor attacks greatly reduce value of product, the crop is heavily sprayed. IPM tools to reduce the fungicide input against apple scab will therefore potentially have high value, and all DSSs covering this disease are prioritised for inclusion on the platform (Table 12).

RIMpro (Version Arbo) incorporates several diseases into the same system. This DSS is widely used in many countries and is well validated in many regions. It requires very detailed weather data in order to provide good recommendations.

QMS fruitteelt/Rimpro covers eleven pests and six diseases. The systems allows for reduction of the number of treatments. Rimpro can use weather data from the growers own weather station to assess the local need for control. The system is user friendly and customizable, allowing users to configure simulation parameters according to preference. Furthermore, fungicide treatments can be entered to follow the estimated remaining effective protective period. Advisors can set of a private network for clients using a custom group of different types of weather stations at different locations.

VIPS, Apple scab model is based on the Mills Criteria, which predicts weather periods conducive to the spread of apple scab disease. The criterion relates temperature and leaf wetness duration. There is a high infection risk if there is sufficient leaf wetness at a given average daily temperature.



Table 12. List of DSSs on apple scab prioritized for inclusion on the platform.

DSS name	RIMpro (Version Arbo)	VIPS, Apple Scab Model	QMS fruitteelt/Rimpro
DSS is covering more diseases	yes	no	yes
DSS requires information on cultivar	yes	no	yes
DSS requires monitoring data	yes	no	yes
DSS requires input on	no	no	yes
DSS requires weather data	yes	yes	yes
DSS requires weather data from user		no	no
DSS requires weather data from system		yes	yes
DSS gives input on fungicides	no	no	yes
DSS is free	no	partly	
Available in English	yes	yes	no
Are the underlying models documented? known to be validated	?	yes	Unknown yes
description of model published			no
developed since			2000
Typically used by farmers	farmer	advisor	farmer
Typically used by advisors	advisor	farmer	advisor
Country of respondent	France	Norway	Netherlands
area where developed		Norway	NL
own by	RIMpro B.V	NIBIO	Company
countries were tested			NL, DEU, BEL, DNK and more

6.6 Aphids

Aphids impact many crops and are seen as serious pests both during summer seasons and in the autumn as vector for spread of viruses like BYDV. Models are typically based on monitoring either in crops or in traps. In some models the observations are linked with temperature models, which is the case for predicting the risk for BYDV in winter cereals.

Potato aphid – Thresholds is a purely observation based system, which indicates risk of aphid attacks in specific areas on a map of The UK. The data are obtained from aphid counts from yellow water traps. The system allows the user to assess the current risk, but also average risk over a certain period. Furthermore, historical data make it possible to identify any developments in pest pressure.



Table 13. List of DSSs on aphids prioritized for inclusion on the platform.

DSS name	Cereal summer aphid hresholds (UK & Sweden)	Potato aphid - Thresholds	Cereal BYDV vectors AHDB live system
DSS is covering more diseases	No	No	No
DSS requires information on cultivar		No	No
DSS requires monitoring data	Yes	Yes	No
DSS requires input on GS	Yes	Yes	
DSS requires weather data	No	No	Yes
DSS is free	Yes	Yes	Yes
Available in English	Yes	Yes	Yes
description of model published	Yes		Yes
Typically used by farmers	Yes	Yes	Yes
Typically used by advisors	Yes	Yes	Yes
Country of respondent	UK/Sweden	UK	UK
area where developed	UK/Sweden	UK	UK
own by	(ADAS)	(ADAS)	AHDB

6.7 Cabbage root fly on oilseed rape

Cabbage root fly, AHDB, UK is among a set of currently excel based systems for forecasting insect pest outbreaks. Through funding from AHDB Horticulture, the equations for four of the MORPH pest models (cabbage root fly, carrot fly, pollen beetle, large narcissus fly) and three day-degree models (lettuce-root aphid, willow-carrot aphid, currant-lettuce aphid) have been extracted and summarised into a spreadsheet-based tool in EXCEL so that they are available to others. These are simpler versions of the models but validations of these initial versions confirm that the approach is valid (Final Report CP 127 - Compendium of pest forecasting models)". (<https://warwick.ac.uk/fac/sci/lifesci/wcc/resources/morphexcel>).

Cabbage root fly - SEGES (DK) is a simple day degree model, which has been shown to give reliable predictions on cabbage root fly outbreaks. The model predicts, when the first and second generation of flies will be fully developed and start laying eggs in the soil near their host plants. The graphical output indicates by colour code the level of risk.

Cabbage root fly – VIPS, Norway consists of several systems including an observation-based warning system for the risk of cabbage root fly outbreaks. It uses thresholds of egg counts, crop sowing date and growth stage as the bases for risk warnings. This system is used by farmers, advisers and researchers. The other system uses weather data to give a prognosis of risk of cabbage root fly outbreak.



Table 14. List of DSSs on cabbage root fly prioritized for inclusion on the platform.

DSS name	Cabbage root fly - AHDB (Morph)	Cabbage root fly - SEGES (Forecast)	Cabbage root fly - VIPS (Forecast)
DSS is covering more diseases	No	No	No
DSS requires information on cultivar	No	No	No
DSS requires monitoring data	No	No	No
DSS requires input on GS (from user/system)	No	No	Yes
DSS requires weather data	Yes	Yes	Yes
DSS is free	Yes	Yes	Yes
Available in English	Yes	Yes	Yes
Are the underlying models documented? known to be validated			Yes
description of model published			Yes
Typically used by farmers	Yes	Yes	Yes
Typically used by advisors	Yes	Yes	Yes
Country of respondent	UK	Denmark	Norway
area where developed	UK	Denmark	Norway
own by	AHDB	SEGES	NIBIO

6.8 Carrot fly on carrot

Carrot fly – VIPS, Norway includes two different ways of evaluating the risk of carrot fly attack. One uses only observation data to evaluate risk based on thresholds for sticky trap catches, while one uses historical and forecast temperature to evaluate the current risk of an outbreak.

Carrot fly AHDB (Morph) see section 6.2.

Table 15. List of DSSs on carrot root fly prioritized for inclusion on the platform.

DSS name	Carrot fly - VIPS (Forecast)	Carrot fly AHDB (Morph)
DSS is covering more diseases	No	No
DSS requires information on cultivar	No	No
DSS requires monitoring data	No	No
DSS requires input on GS (from user/system)	No	No
DSS requires weather data	Yes	Yes
DSS is free	partly	Yes
Available in English	Yes	Yes
Are the underlying models documented?	Yes	Yes
Typically used by farmers	Yes	Yes
Typically used by advisors	Yes	Yes
Country of respondent	Norway	UK
area where developed	Norway	UK
own by	NIBIO	AHDB



6.9 Cutworm, grapevine moth and OWBM

Table 16. List of DSSs on various insects prioritized for inclusion on the platform.

DSS name	Cutworm - ADAS	grapevine moth - NP (Forecast)	OWBM (paper only)
DSS is covering more diseases	No	Maybe	No
DSS requires information on cultivar	No	No	No
DSS requires monitoring data	No	No	No
DSS requires input on GS (from user/system)			Maybe
DSS requires weather data	Yes	Yes	Yes
DSS is free	No	No	Yes
Available in English	Yes	Yes	Yes
description of model published	Yes	Yes	Yes
Typically used by farmers	Yes	Yes	No
Typically used by advisors	Yes	Yes	No
Country of respondent	UK	Greece	Belgium
area where developed	UK	Greece	Belgium
own by	ADAS	Neuropublic	(ADAS)

6.10 Weed control

Information was collected on 6 different DSSs on weeds. Out of these, 5 were included in the priority list. The ranking of the systems is based several criteria (see Table 17) where DSSs that include a given feature receive a score of one otherwise they score zero. The scores were totalled to inform the final ranking.

Table 17. List of DSSs on weeds prioritized for inclusion on the platform. A score of 0 or 1 is given for each criteria.

DSS	Crop Protection Online - Weeds (CPO-Weeds)	DK-RIM	IPMwise	Kerb weather tool	Corteva Grassland App
Fully implemented English version	0	1	1	1	1
Other languages except the DSS developer's	1	0	1	0	0
Agro-region except the DSS developer country	0	0	1	0	0
Price (Free as 1/Cost as 0)	0	1	0	1	1
The DSS provides herbicide efficacy tables	1	1	1	0	-
The DSS provides efficacy of herbicide mixtures	1	0	1	0	-
The DSS provides data about the economic thresholds of applications	1	1	0	0	-
The type of decision is long-term strategic and not short-term tactical	0	1	0	0	-
Format of models (application score as 1/only web based or based on an excel sheet score as 0)	0	0	0	0	1
Weather data required (if yes score as 1/if no score as 0)	1	0	1	1	-
The frequency of weather data input is not daily, but consecutive	0	0	0	1	-
The target crops include many cereals	1	1	1	0	0
There are more than 2 target weeds	1	0	1	1	1
The target weeds are both grasses and broadleaved weeds	1	0	1	1	1
The DSS output about the timing of activities is based upon crop growth stages	1	1	1	0	-
The DSS provides data about the seed bank effect of the recommended applications	0	1	1	0	-
The DSS consider herbicide resistance through the recommendations	1	1	1	0	-
The DSS provides weed identification guides to users	1	0	1	0	1
SUM	11	9	13	6	6



7 Examples of input and output from visual catalogue of DSSs

In order to understand how DSSs express the risk and data requirements, a collection of input and output screenshots from the different DSSs have been put together.

Crop protection online, Denmark

Input

Growth stage: 51. Beginning earing

Percent of plants infected:¹⁾

Mildew: 11-25
Septoria: 0
Brown rust: 1-10
Yellow rust: 11-25

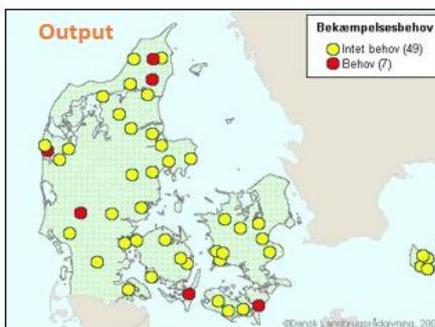
Eyespot¹⁾: Not counted
Aphids: 0
Cereal leaf beetle larva: 0

*) Assessment of leaf diseases of strawbeakers infected.
1) In growth stage 51 infection of the disease or pest has no economic importance.

Precipitation during the past 30 days:
Number of days with precipitation of more than 1 mm: 8

5 days weather forecast:
Are temperatures above 20 degrees C expected:
Is heavy rain expected:

Other:
Is a simultaneously treatment against weeds necessary:
Has yellow rust been observed in the field earlier this season:



diseases	Examples of thresholds
Mildew	>10% plants attacked from GS 29 (S) >25% plants attacked from GS 29 (R) After GS 40 no recommendations
Septoria	4 days with precipitation from GS 32 (S) 5 days with precipitation from GS 37 (R) Or attack on third leaf from GS 46-60
Yellow rust	GS 29-60 1% plant attacked in susceptible cultivars

Protection Online
and pests - Recommendation

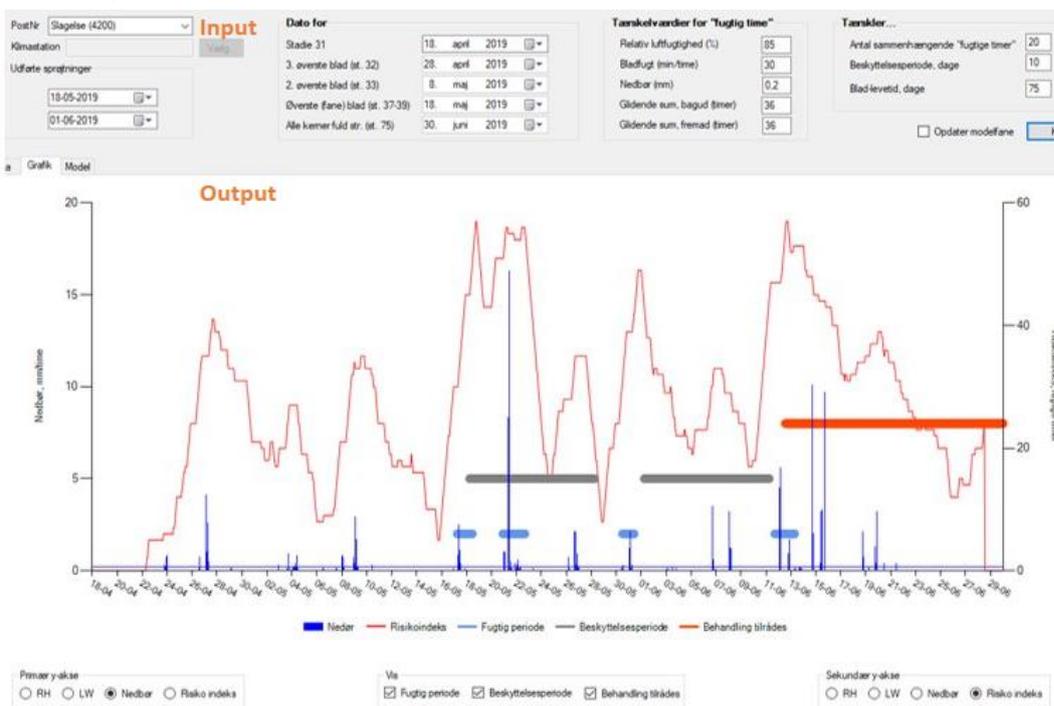
at: Harslev

Recommendation:
Diseases: There is a need for treatment against Septoria, Yellow rust.
Pests: There is no need for treatment against pests.

Proposals for treatment:
Against leaf diseases:

Proposals	Product	Standard	Actual
1	Mandis 125 SC	1.00	0.27
2	Opus	1.00	0.27
3	Rubric +	1.00	0.27
4	Opus	2.0	0.5
5	Mandis 125 SC	1.00	0.19
	Conat +	1.00	0.10
	Mix total		
6	Opus	1.00	0.19
	Conat +	1.00	0.10
	Mix total		
7	Rubric +	1.00	0.10
	Conat +	1.00	0.10
	Mix total		

Humidity model, Denmark



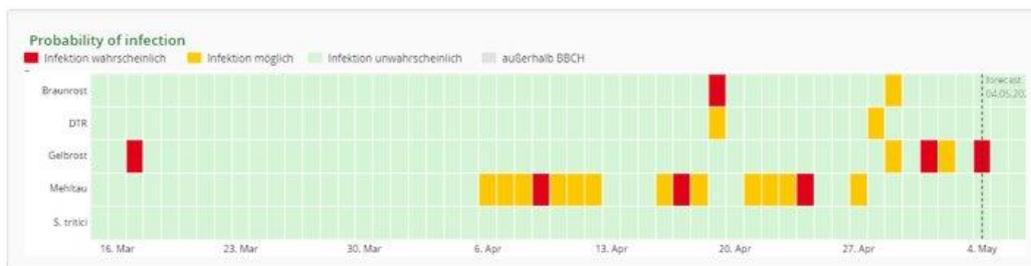
ISIP, septoria model, Germany

result details map

illness: S. tritici ■ Infektion wahrscheinlich ■ Infektion möglich ■ Infektion unwahrscheinlich ■ außerhalb BBCH

Surname	April				May			forecast		
	27	28	29	30th	1	2nd	3rd	4th	5	6
Bad Kreuznach										

field overview



Field data ☰

Name and location

Name *

Position *

Zip or City

Culture

Sowing date * 📅

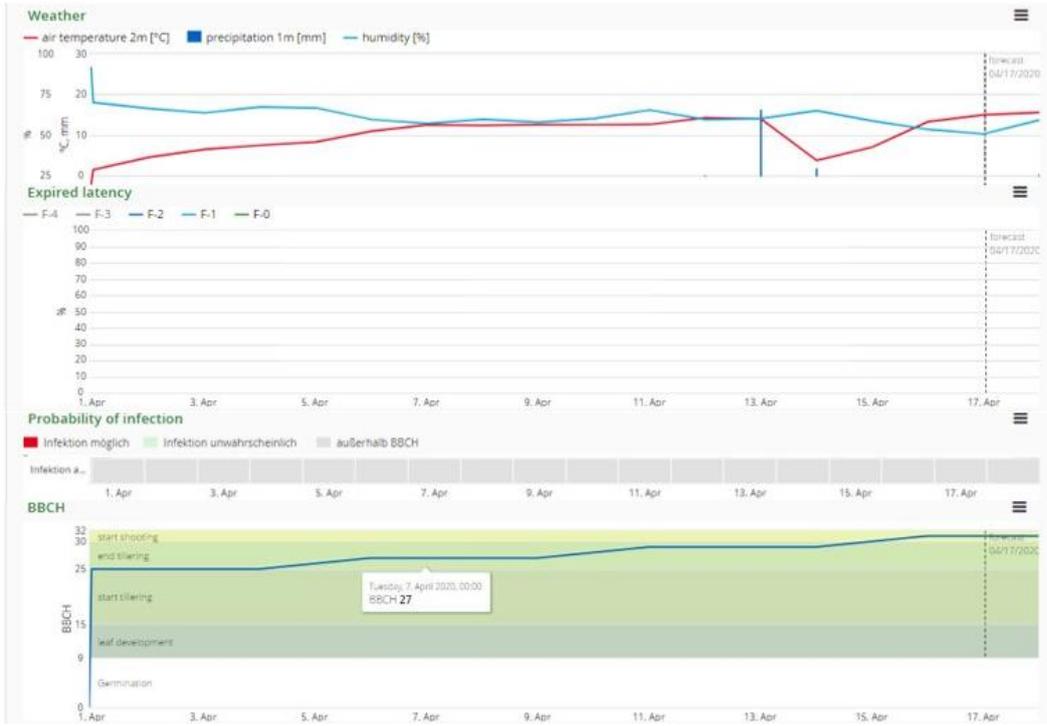
variety * ▼

Stage of observation ▼

Observation date 📅

Abort
to save
Clear





CropMonitor Pro, UK

Winter wheat

- Decision support
- Growth stages
- Resistance ratings
- Diseases**
 - Brown rust
 - Eyespot
 - Fusarium ear blight
 - Powdery mildew
 - ← Septoria tritici
 - Tan spot
 - Yellow rust
- Pests**

Case study site

Farm name: Fera
Field name: Winter wheat case study
Growth Stage: 35
Click marker to view site risk information
Please note that for case study site, risks and weather metrics are calculated based on weather data from elsewhere in the country.

Low risk
Moderate risk
High risk

Septoria tritici

Farm name: Fera
Field name: Winter wheat case study

Sow date	Cultivar	Tillage regime	Previous crop (last year)	Previous crop (year before last)	Current GS
20/09/2019	JB Diego	Minimum tillage	Winter oilseed rape	Winter wheat	35

Show more ▾

Seasonal risk for current year

Risk of a significant epidemic (severity on top 3 leaves > 5%) occurring at GS75 based on weather experienced up to GS31

Daily infection risk estimates (R/A/G risk categories)

Apr

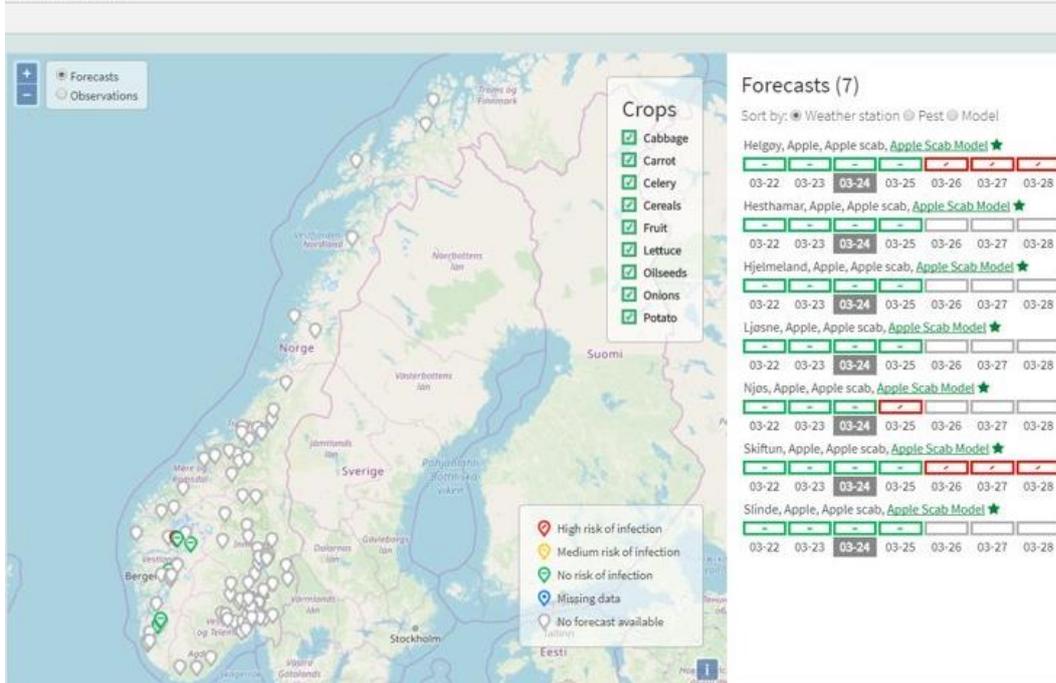
	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21 (Today)	22	23	24	25
Cultivar																			
JB Diego	Low	High	High	High	High	High													





Vips, apple scab model, Norway

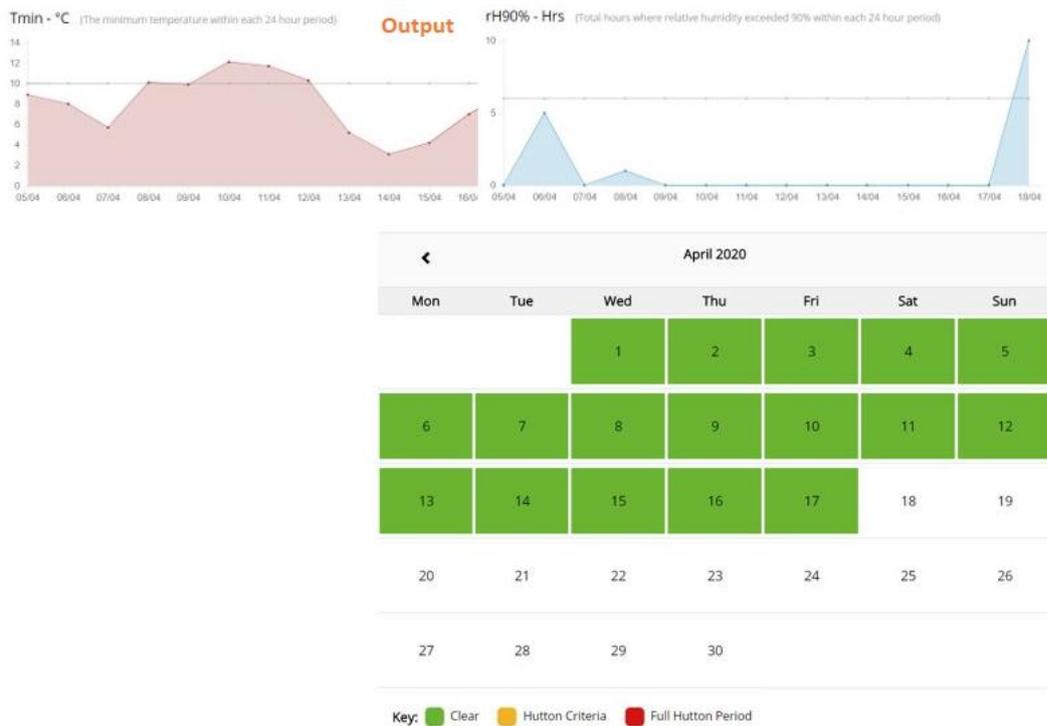
w.vips-landbruk.no



Horizon 2020



Blightwatch, UK



ISIP (simblight/simphyt), Germany

ISIP (simblight/simphyt)

ZEPP

Input:

1. Location.
2. Variety.
3. Date.
4. Cultivation density.
5. Navigability of field (Field cannot be driven on for at least 4 consecutive days between planting and 7 days after emergence).
6. Sporulating Infestation observed.
7. Weed present.
8. Fungicide used at last application
9. Precipitation since last application and fungicide type used.

1) Schlagname:
 Koordinaten: RID: 128459

2) Sorte:

3) Auflaufdatum:

4) Anbaudichte: gering (< 10 %) hoch (>= 10 %)

5) Schlag nicht befahrbar: Nein Ja
 (Schlag im Zeitraum von der Pflanzung bis 7 Tage nach Auflauf an mindestens 4 aufeinander folgenden Tagen nicht befahrbar)
 Besonders gefährdeter Schlag: Hilfe

6) Sporulierender Befall beobachtet: Ja Nein

7) Krautwachstum: abgeschlossen normal stark sehr stark

8) Bei letzter Spritzung verwendetes Fungizid: systemisch teilsystemisch Kontakt

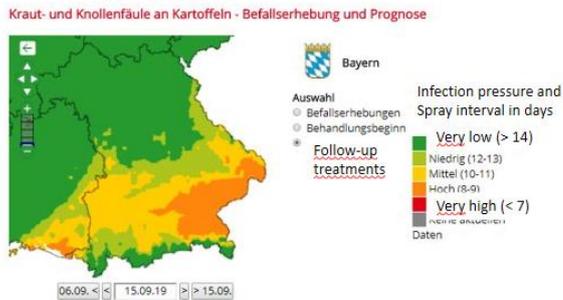
9) Niederschlag auf der Fläche seit letzter Spritzung mit...: nicht-sporizidem Kontaktmittel system., teilsystem. oder sporizidem Kontaktmittel
 0 mm 0-9 mm
 1-5 mm 10-15 mm
 6-10 mm 16-20 mm
 > 10mm > 20mm



Horizon 2020

ISIP (simblight/simphyt)
ZEPP

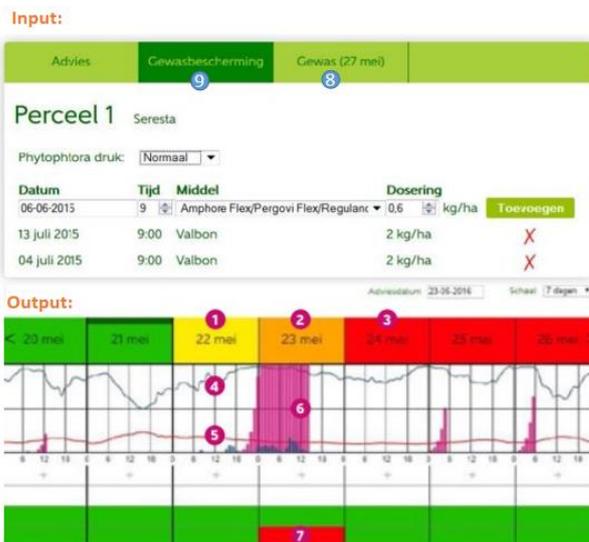
Output:



Late blight app, The Netherlands

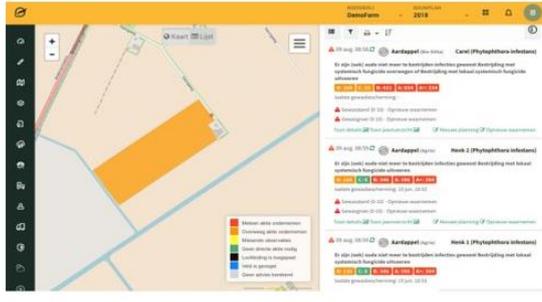
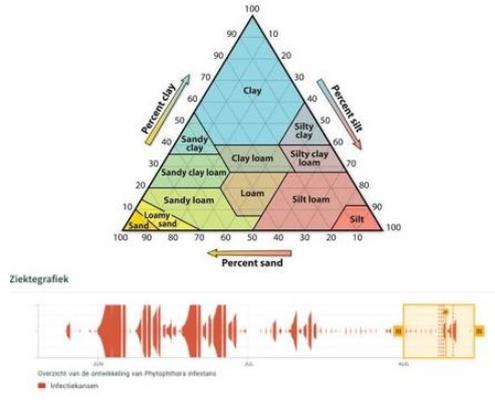
Late blight app
Wageningen Research

1. Yellow: Preventive treatment advised
2. Orange: curative treatment advised
3. Red: stop spraying advised
4. Air humidity %
5. Temperature C
6. Red: leaf infection risk%. Blue: Displays precipitation in mm.
7. Red: Risk of oospores/tuber infection. Green: No risk of oospores/tuber infection
8. Input: Emergence date
9. Input: Select the correct phytophthora pressure here and add the correct spray treatment



Ziektemanagement, The Netherlands

Ziektemanagement
Dacom/agrovision



Fight against blight, UK

Start Date: 01/03/2019 End Date: 21/04/2020 Status: ▼ Source: ▼
 Scale: ▼ Variety: ▼ Crop Type: All Crops ▼
Input Apply Clear



Genotype summary - Scotland

Genotype	Lesion samples
EU_13_A2	17
EU_36_A2	13
EU_37_A2	3
EU_6_A1	52
EU_8_A1	10
Other - unnamed	36
Total number of outbreaks:	38

Mileos, France

DÉTAILS DE LA PARCELLE Modifier la parcelle

Société : EARL LEVEILLE
Parcelle : Champs du haut
Station : Boigneville (4)
(dernières données : 06-06-2018 6H TU)
Station de prévision : BRICY
Variété : AGATA
Seuil de poids de contamination : 2
Date de levée : 04-05-2018



16-05-2018

CONSEIL

En fonction de vos traitements, aucune intervention n'est à réaliser le 06-06-2018.

Afficher les données météo manquantes

	Reels				Prévisionnels				
	0.0 Pas de risque	0.0 Vigilance	0.0 Risque	0.0 Pas de risque	0.0 Vigilance	0.0 Risque	0.0 Pas de risque	0.0 Vigilance	0.0 Risque
	< 02-06-2018	03-06-2018	04-06-2018	05-06-2018	06-06-2018	07-06-2018	08-06-2018	>	
Réserve de spores	1.86	1.86	1.47	2.83	1.04	3.09	3.23	3.23	
Index de contamination	8.97	4.84	6.43	16.63	10.08	26.93	33.03	10.60	
Poids de contamination	1.15	0.00	0.00	2.83	0.79	3.09	3.09	3.05	
Pluie (en mm) <small>Visualiser / Corriger la pluviométrie</small>	0.00	3.80	1.80	8.40	0.40		ND	ND	
Résistance au lessivage restante (en mm)	0.00	0.00	100.00	91.60	91.20	91.20	91.20	91.20	
Parcelle protégée ?	Non	Non	OUI	OUI	OUI	OUI	OUI	OUI	

Afficher les indices du Afficher

- + Ajouter un traitement
- + Ajouter une irrigation
- + Ajouter une observation

Optidose, France

Optidose®
Institut Français
de la Vigne et du Vin
(IFV)

Input:

- Location.
- Crop growth stage.
- Crop dimensions and row width.
- Cultivation density.
- Disease resistance.

1 - Risque sur votre parcelle
2 - Etat de votre parcelle
3 - Paramétrage du pulvérisateur
4 - Résultats du calcul de doses

Choisissez votre commune pour obtenir une évaluation indicative des risques de mildiou et d'oïdium :

Input Département Commune

Distance Centre commune - Point de calcul : 4.7 km
Date du dernier calcul : 21/04/2020

Output

Evaluation du risque de maladies sur votre commune (en fonction des jours)

Maladie	Risk calculated with observed weather data							Risk calculated with forecast data			
	J-7	J-6	J-5	J-4	J-3	J-2	J-1	J0	J+1	J+2	J+3
Mildiou	2	2	2	2	2	2	2	2	2	2	2
Oïdium	3	3	3	3	3	3	3	3	3	3	3

Input

Entrez les valeurs de risque que vous retenir pour chacune des maladies :

Risque Mildiou Risque Oïdium Valider mes risques retenus



Input:

- Location.
- Crop growth stage.
- Crop dimensions and row width.
- Cultivation density.
- Disease resistance.

Paramètres de votre vigne

Input: Stade phénologique * 2-3 feuilles étalées (E)

D - Inter-Rang : * 10 mètres

H - Hauteur de feuillage : * 1 mètres

L - Largeur de feuillage : * 1 mètres

Volume de hale foliaire (TRV) * 1000 m3/ha

Sensibilité de votre parcelle au mildiou * Normal

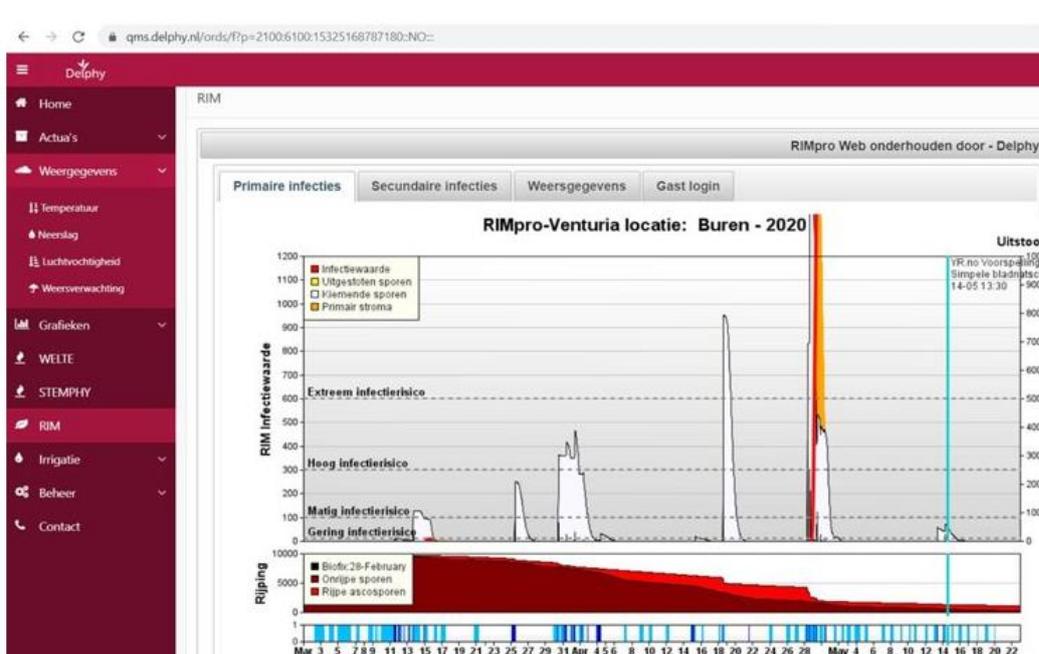
Sensibilité de votre parcelle à l'oïdium * Normal

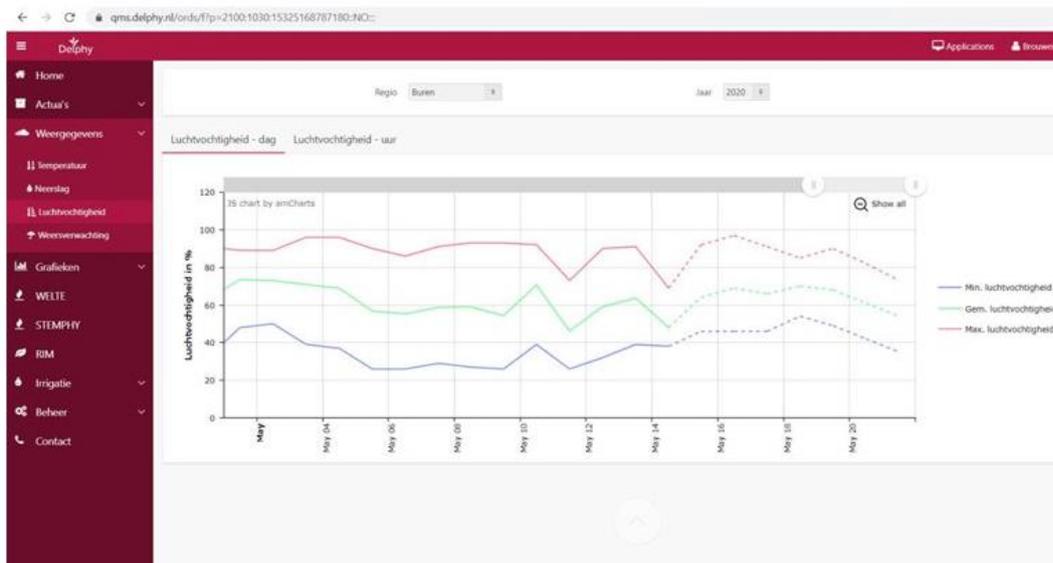
Valider

Output

Doses à utiliser (en % de la dose homologuée)	Doses to use (in % of the approved dose):	
pour le traitement du mildiou :	Downy mildew	20 %
pour le traitement de l'oïdium :	Powdery mildew	20 %

QMS fruitteels/Rimpro, The Netherlands





OSR Sclerotinia risk report, UK

Sclerotinia infection risk alerts

This traffic-light system highlights the weather-based² sclerotinia infection alert status at UK sites.



² Our research shows that risk-based sclerotinia control decisions can reduce spray requirements and improve spray timing

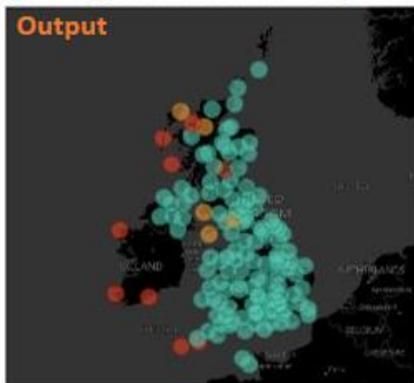
Input

Filter by: **Region**

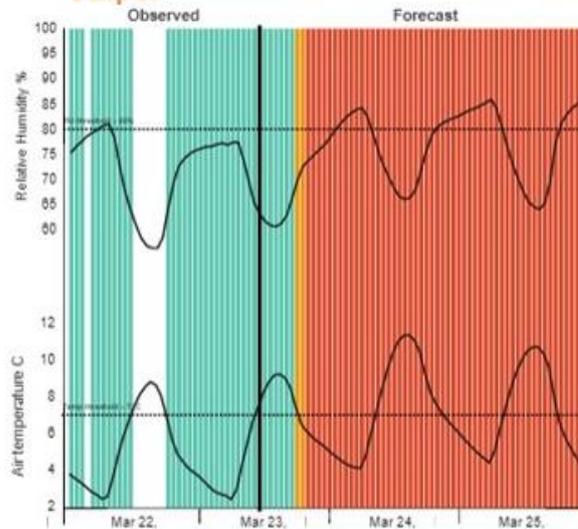
Sclerotinia infection conditions over today and next 48 hrs

- < 21 hrs
- 21-22 hrs or >=23 with 'near miss'
- >= 23 hrs

Output



Output



Horizon 2020

Light leaf spot, UK

Light leaf spot AHDB

Input:

1. Location

or click map to select area:



Disclaimer

Step 2 - Variety

The severity of light leaf spot
Variety with * is not on the

Forecast for East of

- Alizze (7)
- Annalise (6)*
- Anastasia (7)
- Aquila (6)
- Architect (6)
- Aspire (7)
- Arrow (7)*
- Ballad (6)
- Barbados (8)
- Broadway (7)
- Butterfly (7)
- Campus (6)
- Crome (6)

Step 3 - Date Sown

Progress of the disease depends on how

Forecast for Alizze:7

Forecast for E:

Forecast for East of England

- Sowing date:
- Before 14th August
 - Between 14th August
 - 14th August - 20th August
 - 21st August - 27th August
 - 28th August - 3rd September
 - 4th September - 10th September
 - 11th September - 17th September
 - After 17th September



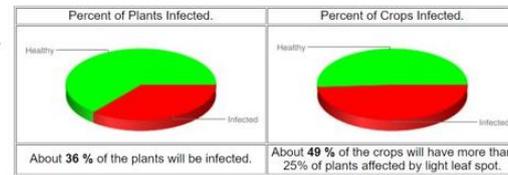
Output:

Step 4 - Light Leaf Spot Forecast in Winter Oilseed Rape

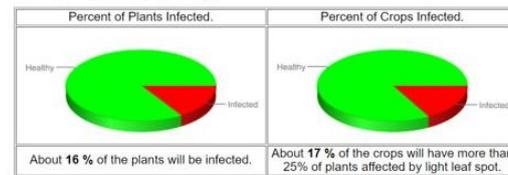
Customized forecast for a farm in East of England

Cultivar	Annalise
Resistance Rating	6
Week Sown	28th August - 3rd September

If no Autumn fungicide spray applied



If Autumn fungicide spray was applied



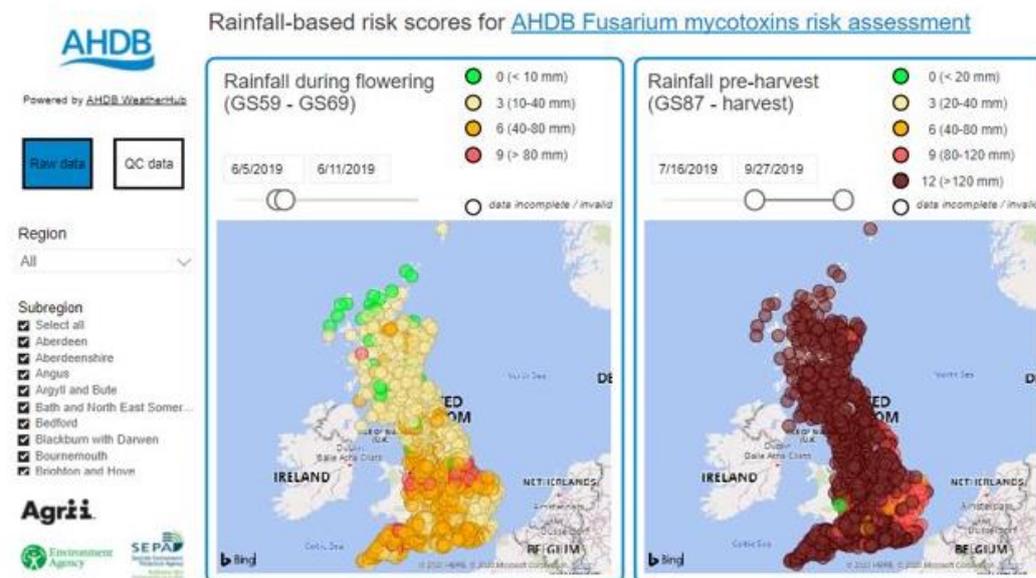
Mycotoxin risk tool, UK

Mycotoxin rainfall risk tool

Rainfall-related mycotoxin risk assessment scores can now be calculated automatically with this tool.

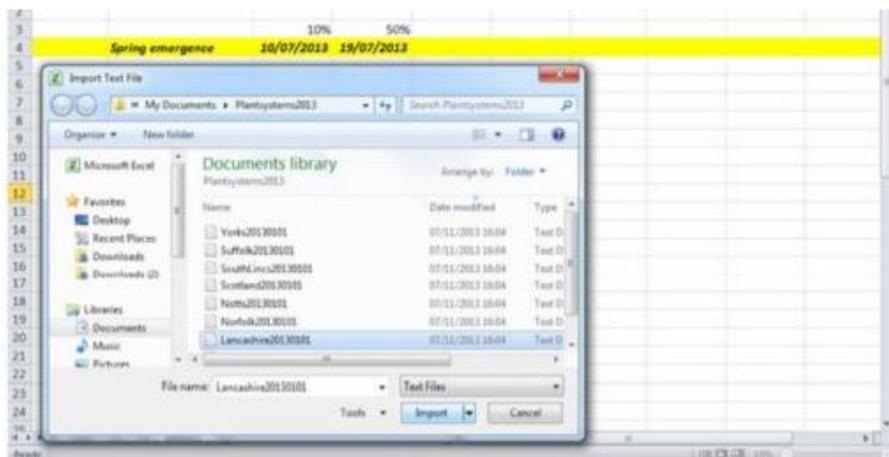
Covering thousands of sites across England and Scotland, the map-based tool also shows how much rain has fallen during the critical winter wheat flowering and pre-harvest periods.

[Find out more](#)



Cabbage root fly, UK

Input:



Output: **Figure 1.** Screenshot showing prompt to upload weather data.

Presentation of the outputs

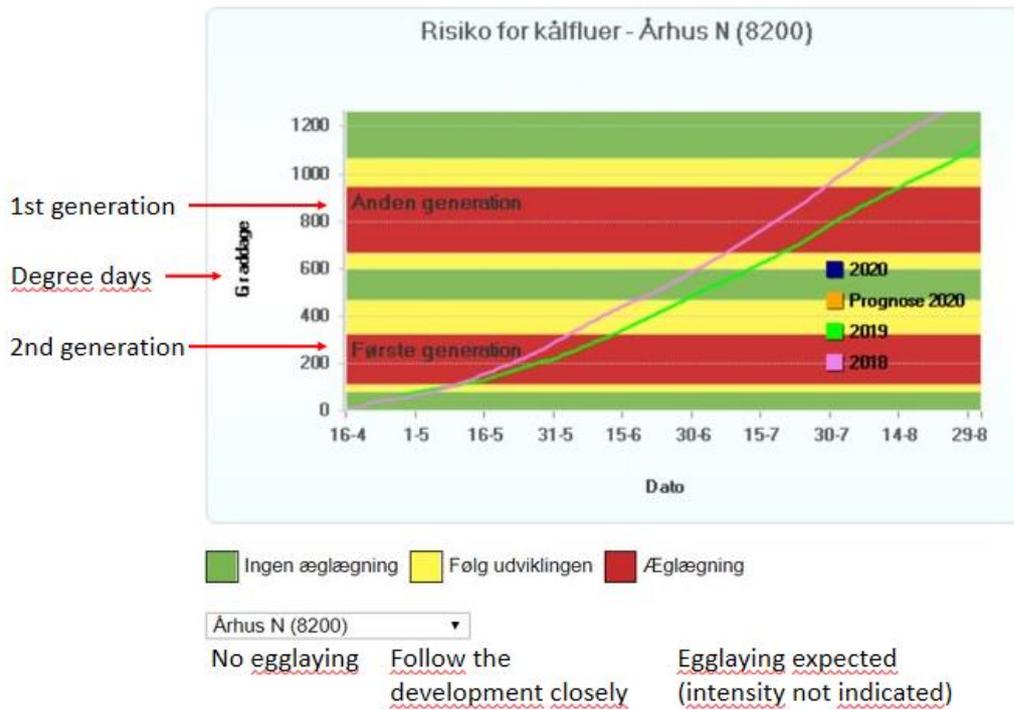
The results are looked up and extracted onto the 'Results' page of the spreadsheet (Figure 5). This summarises, for example, the dates of 10% and 50% emergence in the spring, or 10% and 50% egg-laying.

	10%	50%
Spring emergence	25/06/2013	09/07/2013

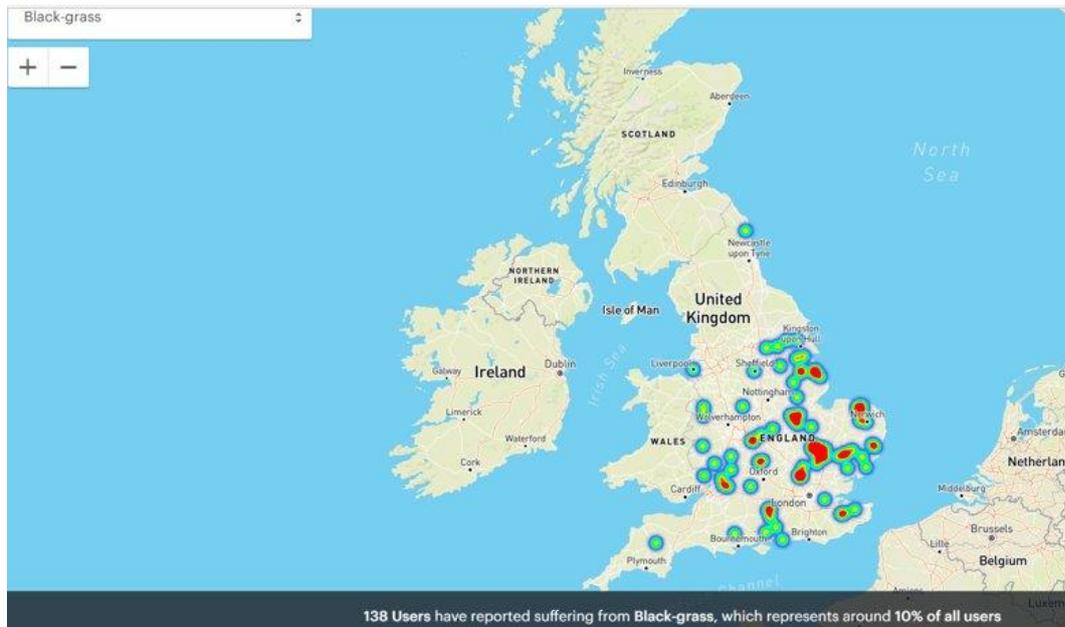
Figure 5. Screenshot showing an example of the output.



Kålfluer – varslning for æglægning (summer cabbage fly egg laying warning)

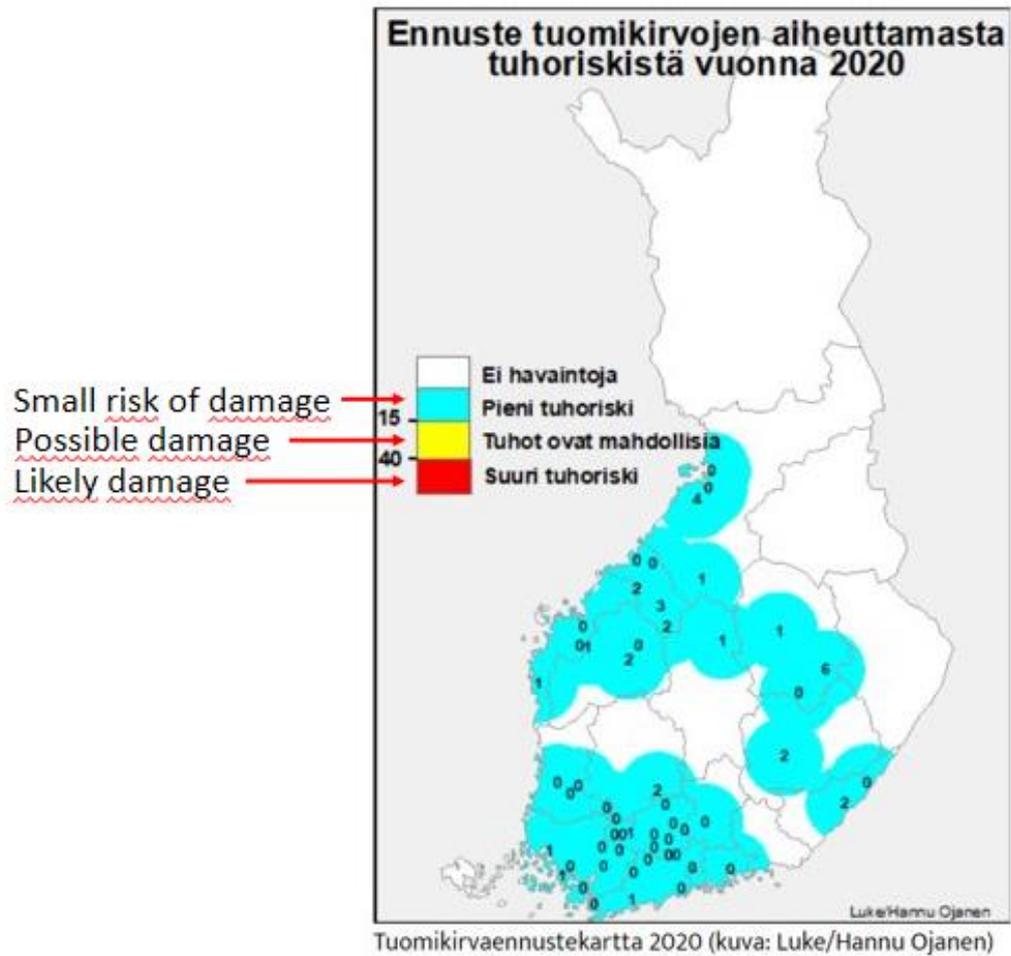


Crop protect app, UK



Horizon 2020

Cabbage root fly, Finland



Potato aphid monitoring, UK

Aphid monitoring water trap results for 2020



We have received a total of 2 samples so far in 2020.

Map Controls

Average weekly index for 2020

Date slider

Year slider

Select your view

Average weekly index Specific date

● 0.0 - 2.0
● 2.01 - 10.0
● >10.0
○ No Sample received

If a regions bounding box is coloured red, then at least one Peach-Potato aphid has been captured in the last 10 days in that region. If there is a date to the left of a region, this is the date the first peach-potato aphid was captured in that region.

Aphid Monitoring

Potato Virus Y (PVY) is a serious threat to high grade seed potato production because **even low levels** of PVY will downgrade seed. [Discover the benefits of being part of our aphid monitoring scheme.](#)

Contact Details



Horizon 2020

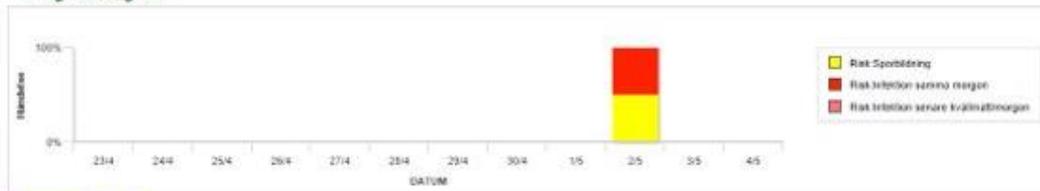


Lökbladmögel, MA-model, Sweden

Prognos LÖKBLADMÖGEL (15-minutersvärden) Alnarp [24688], 20200424-20200504

[Åter till Söksidan](#)

Prognos-diagram

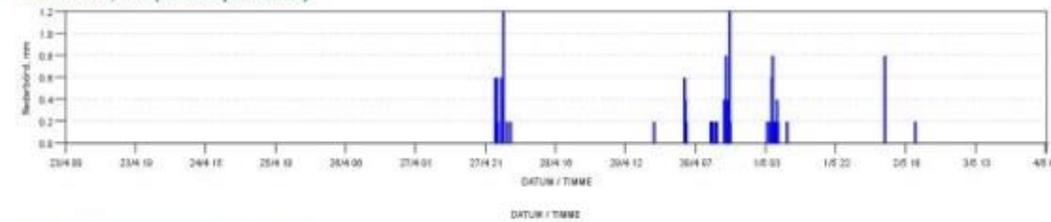


Sporsvårigheter: 0502:0

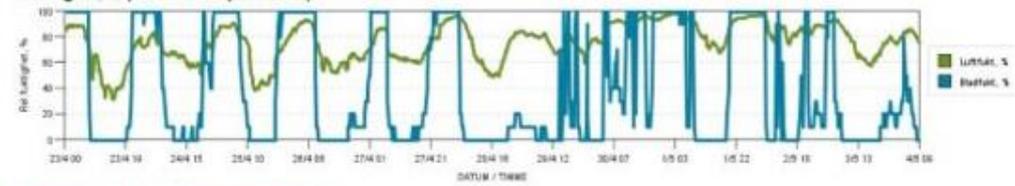
Infektionsnivå: 0503:800

Spordid

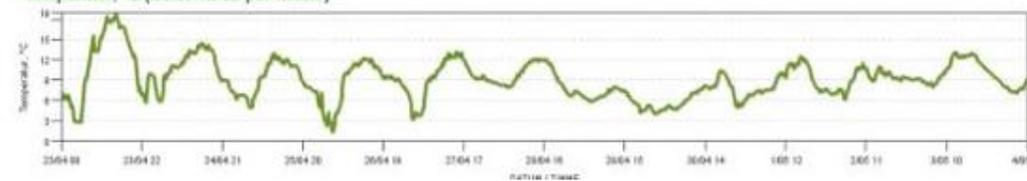
Nederbörd, mm (summa per timme)



Fuktighet, % (medelvärde per timme)



Temperatur, °C (medelvärde per timme)



IPMwise, Denmark

Input

Consultation Help

Personal settings
 Demo H2020

Crop: Barley, spring | Undersown: Clover, red | Crop growth stage: 14 4th leaf enfolded | Expected yield: Low

Water stress: None | Minimum temperature: 8 | Maximum temperature: 14 | Find lowest: **Cost (Price)**
Treatment frequency index (TFI) | Load indicator (E-load)

Weed name: Avena fatua L. | Weed size: 0-1 leaf | Weed density: Few pl/field | Effect goal: **IPM** Forge
---- Select ---- | 0-1 leaf | Few pl/field | IPM | New / delete

Show options for prevention of resistance Help

My herbicides is OFF. You can modify this setting in: [My herbicides](#)
 [Need more options?](#)

Output

Consultation © 2020 - IPM Consult ApS

Crop: Barley, spring | Undersown: Clover, red | Crop growth stage: 14 4th leaf enfolded
 Water stress: None | Temperature: 8 °C - 14 °C | Find lowest: Cost (Price)
 Avena fatua L.: 0-1 leaf, Few pl/field, 82%

Suggestions	Price (DKK/ha)	TFI	E-Load	MOA			
▼ Foxtrot (0.43 l) + DLG Contact (0.2 l)	110.13	0.43	0.22	A*			
Tradename	Dose / ha	Max dose / ha	Unit	Price (DKK/ha)	TFI	E-Load	MOA
Foxtrot	0.425	1	l	104.13	0.43	0.22	A*
> DLG Contact	0.2	0.2	l	6	0	0	
Weed name	Expected effect (%)	Desired effect (%)	Sufficient effect by IPM (%)				
Avena fatua L.	82	82	82				
> Primera Super (0.43 l) + DLG Contact (0.4 l)	116.13	0.43	0.22	A*			



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Link to Endure reports.

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9 Supplementary – list of target names and Eppo codes.

Table S1. Names of target pathogens.

Crop	English name	Latin name	Eppo code
Allium	downy mildew	<i>Peronospora destructor</i>	PERODE
Almonds	brown rot blossom blight	<i>Monilinia fructicola</i>	MONIFC
Almonds	leaf curl	<i>Taphrina deformans</i>	TAPHDE
Apple	fireblight	<i>Erwinia amylovora</i>	ERWIAM
Apple	fly speck of apple	<i>Schizothyrium pomi</i>	SCHIPO
Apple	apple scab	<i>Venturia inaequalis</i>	VENTIN
Apple	brown spot	<i>Pleospora allii</i>	PLEOAL
Apple	powdery mildew of apple	<i>Podosphaera leucotricha</i>	PODOLE
Artichock	downy mildew	<i>Bremia lactucae</i>	BREMLA
Barley	powdery mildew of barley	<i>Blumeria graminis</i> f. sp. <i>hordei</i>	ERYSGH
Barley	brown rust	<i>Puccinia hordei</i>	PUCCHD
Barley	net blotch	<i>Pyrenophora teres</i>	PYRNTE
Barley	scald of cereals	<i>Rhynchosporium secalis</i>	RHYNSE
Celery	late blight of celery	<i>Septoria apiicola</i>	SEPTAP
Grapes	downy mildew of grapevine	<i>Plasmopara viticola</i>	PLASVI
Grapes	powdery mildew of grapevine	<i>Erysiphe necator</i>	UNCINE
Grapevine	downy mildew of grapevine	<i>Plasmopara viticola</i>	PLASVI
Grapevine	powdery mildew of grapevine	<i>Erysiphe necator</i>	UNCINE
Legumes	leaf blight of bean	<i>Alternaria alternata</i>	ALTEAL
Legumes	anthracnose of bean	<i>Colletotrichum lindemuthianum</i>	COLLLD
Legumes	rust of bean	<i>Uromyces appendiculatus</i>	UROMAP
Legumes	leaf blight of pea	<i>Didymella pinodes</i>	YCOPI
Lettuce	downy mildew	<i>Bremia lactucae</i>	BREMLA
Oat	powdery mildew of cereals	<i>Erysiphe graminis</i>	ERYSGR
Oilseed rape	dark spot of crucifers	<i>Alternaria brassicae</i>	ALTEBA
Oilseed rape	black spot of crucifers	<i>Alternaria brassicicola</i>	ALTEBI
Oilseed rape	Phoma leaf spot	<i>Plenodomus biglobosus</i>	LEPTBG
Oilseed rape	black leg of crucifers	<i>Plenodomus lingam</i>	LEPTMA
Oilseed rape	light leaf spot	<i>Pyrenopeziza brassicae</i>	PYRPBR
Oilseed rape	Sclerotinia stem rot	<i>Sclerotinia sclerotiorum</i>	SCLESC
Olives	leaf spot of olive	<i>Venturia oleagina</i>	CYCLOL
Peaches	brown rot	<i>Monilinia fructicola</i>	MONIFC
Peaches	powdery mildew of peach	<i>Podosphaera pannosa</i>	SPHRPA
Peaches	shot-hole of stone fruit	<i>Wilsonomyces carpophilus</i>	STIGCA
Peaches	leaf curl of peach	<i>Taphrina deformans</i>	TAPHDE
Pistachio	septoria	<i>Septoria</i> sp.	SEPTSP
Potato	alternaria blight	<i>Alternaria alternata</i>	ALTEAL
Potato	early blight of potato	<i>Alternaria solani</i>	ALTESO
Potato	late blight of potato	<i>Phytophthora infestans</i>	PHYTIN
Rye	powdery mildew of cereals	<i>Blumeria graminis</i>	ERYSGR
Rye	brown rust	<i>Puccinia recondita</i> f. sp. <i>recondita</i>	PUCRRR
Wheat	leaf and glume blotch of wheat	<i>Parastagonospora nodorum</i>	LEPTNO
Wheat	powdery mildew of wheat	<i>Blumeria graminis</i> f. sp. <i>tritici</i>	ERYSGT
Wheat	fusarium head blight	<i>Fusarium</i> sp.	FUSASP
Wheat	eyespot of cereals	<i>Oculimacula yallundae</i>	PSDCHE
Wheat	brown rust	<i>Puccinia triticae</i>	PUCCRT
Wheat	yellow rust	<i>Puccinia striiformis</i>	PUCST
Wheat	tan spot of wheat	<i>Pyrenophora tritici-repentis</i>	PYRNTR
Wheat	septoria tritici blotch	<i>Zymoseptoria tritici</i>	SEPTTR



Table S2. Names of target insects.

Crop	English name	Latin name	EPPO code
Almonds	almond wasp	<i>Eurytoma amygdali</i>	EURTAM
Apple	apple fruit moth	<i>Argyresthia conjugella</i>	ARGYCO
Apple	codling moth	<i>Cydia pomonella</i>	CARPPO
Apple	apple sawfly	<i>Hoplocampa testudinea</i>	HOPLTE
Barley	cereal leaf beetle	<i>Oulema melanopus</i>	LEMAME
Cabbage	cabbage moth	<i>Mamestra brassicae</i>	BARABR
Cabbage	summer cabbage fly	<i>Delia floralis</i>	HYLEFL
Cabbage	cabbage root fly	<i>Delia radicum</i>	HYLERA
Carrots	willow-carrot aphid	<i>Cavariella aegopodii</i>	CAVAAE
Carrots	carrot fly	<i>Chamaepsila rosae</i>	PSILRO
Carrots, beets, parsnips, Celery and leeks.	turnip moth	<i>Agrotis segetum</i>	AGROSE
Cereals	wheat bulb fly	<i>Delia coarctata</i>	HYLECO
Crucifers	cabbage root fly	<i>Delia radicum</i>	HYLERA
Grapes	European grapevine moth	<i>Lobesia botrana</i>	POLYBO
Lettuce	lettuce root aphid	<i>Pemphigus bursarius</i>	PEMPBU
Narcissus	Large narcissus fly	<i>Merodon equestris</i>	LAMTEQ
Oilseed rape	turnip sawfly	<i>Athalia rosae</i>	ATALCO
Oilseed rape	mealy cabbage aphid	<i>Brevicoryne brassicae</i>	BRVCBR
Oilseed rape	cabbage seed weevil	<i>Ceutorhynchus obstrictus</i>	CEUTAS
Oilseed rape	pollen beetle	<i>Brassicogethes aeneus</i>	MELIAE
Oilseed rape	cabbage stem flea beetle	<i>Psylliodes chrysocephala</i>	PSYICH
Onion	downy mildew	<i>Peronospora destructor</i>	PERODE
Peaches	peach worm	<i>Anarsia lineatella</i>	ANARLI
Peaches	summer fruit tortrix	<i>Adoxophyes orana</i>	CAPURE
Peaches	peach tip moth	<i>Grapholita molesta</i>	LASPMO
Potato	peach-potato aphid	<i>Myzus persicae</i>	MYZUPE
Potato	potato moth	<i>Phthorimaea operculella</i>	PHTOOP
<i>Ribes</i> spp.	currant-lettuce aphid	<i>Hyperomyzus lactucae</i>	HYPELA
Vegetables	European tarnished plant bug	<i>Lygus rugulipennis</i>	LYGURU
Wheat	barley gout fly	<i>Chlorops pumilionis</i>	CHLPPU
Wheat	cereal leaf beetle	<i>Oulema melanopus</i>	LEMAME
Wheat	grain aphid	<i>Sitobion avenae</i>	MACSAV
Wheat	rose-grain aphid	<i>Metopolophium dirhodum</i> ,	METODR
Wheat	orange wheat gall midge	<i>Sitodiplosis mosellana</i>	SITDMO

Table S3. Names of target weeds.

Crop	English name	Latin name	EPPO code
Annual meadow-grass	wild oat	<i>Avena fatua</i>	AVEFA
Annual meadow-grass	Barren brome	<i>Bromus sterilis</i>	BROST
Grassland	thistle	<i>Cirsium arvense</i>	CIRAR
Grassland	dock	<i>Rumex crispus</i>	RUMCR
Grassland	dicotyledonous weed plants		TTTDD
Oilseed rape	blackgrass	<i>Alopecurus myosuroides</i>	ALOMY
Oilseed rape	chickweed	<i>Stellaria media</i>	STEME
Potato	kill of haulm		YKRAU
Cereals/Oilseed rape/Legumes	blackgrass	<i>Alopecurus myosuroides</i>	ALOMY
Cereals/Oilseed rape/Legumes.	Italian ryegrass	<i>Lolium multiflorum</i>	LOLMU
Cereals/Oilseed rape/Legumes.	ratstail fescue	<i>Vulpia myuros</i>	VLPMY

