



Deliverable 2.5

Report on Trap Nursery Data Management System

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List of Abbreviations and Acronyms

GRRC	Global Rust Reference Center
LR	Leaf Rust
SPDMS	Sentinel Plot Data Management System
SR	Stem Rust
VSCU	Value for Sustainable Cultivation and Use
WRT	Wheat Rust Toolbox
YR	Yellow Rust

EXECUTIVE SUMMARY

The **Sentinel Plot Data Management System (SPDMS)** is a component of the **Wheat Rust Toolbox (WRT)**, designed for the management, analysis, and visualization of data from the VSCU wheat rust disease sentinel plot network. Disease severity is assessed in the field on a common set of twelve rust differential cultivars, while race phenotyping and genotyping of *Puccinia striiformis* (yellow rust), *P. triticina* (leaf rust), and *P. graminis f. sp. tritici* (stem rust) are conducted on isolates submitted to specialized diagnostic laboratories.

The differential set comprises twelve cultivars carrying key resistance genes against the three major rust pathogens. The primary objectives of the SPDMS are to: i) provide an early indication of emerging yellow rust (YR), leaf rust (LR), and stem rust (SR) virulences within EU VSCU trials; ii) identify rust races and/or genotypes through the analysis of infected leaf samples submitted to designated laboratories; and iii) contribute to a European disease mapping tool that visualizes the distribution and intensity of YR, LR, and SR at VSCU trial sites, as well as the evolution and spread of new pathogen variants. This report serves as both a technical documentation of the SPDMS and a user guide for its associated tools and services. It forms part of the *IPMorama* project and specifically relates to Tasks 2.1 and 2.5, illustrating their functional interconnections and data workflows.

In autumn 2024, approximately 97 trials were established across 90 trial sites in 17 EU member states. A VSCU guide was created by GEVES & Aarhus University for experimenters explaining the SPDMS running and 2 online trainings were delivered on this topic in May 2025. Data were reported from 58 trials. A total of 110 leaf rust samples and 140 yellow rust samples were collected and submitted to RustWatch laboratories for genotyping and/or race phenotyping. The results from the 2025 VSCU trials provided clear evidence of the first detection and subsequent spread of a new *YR15* race in Europe.

- <https://agro.au.dk/forskning/internationale-platforme/wheatrust/news-and-events/news-item/artikel/yr15-virulence-in-yellow-rust-confirmed-in-continental-europe>
- <https://ipmorama.eu/2025/06/17/yr15-yellow-rust-europe/>

For the campaign 2025-2026, differentials were multiplied in 2025 and sent in september 2025 to 85 VSCU & breeder's trials from 20 countries

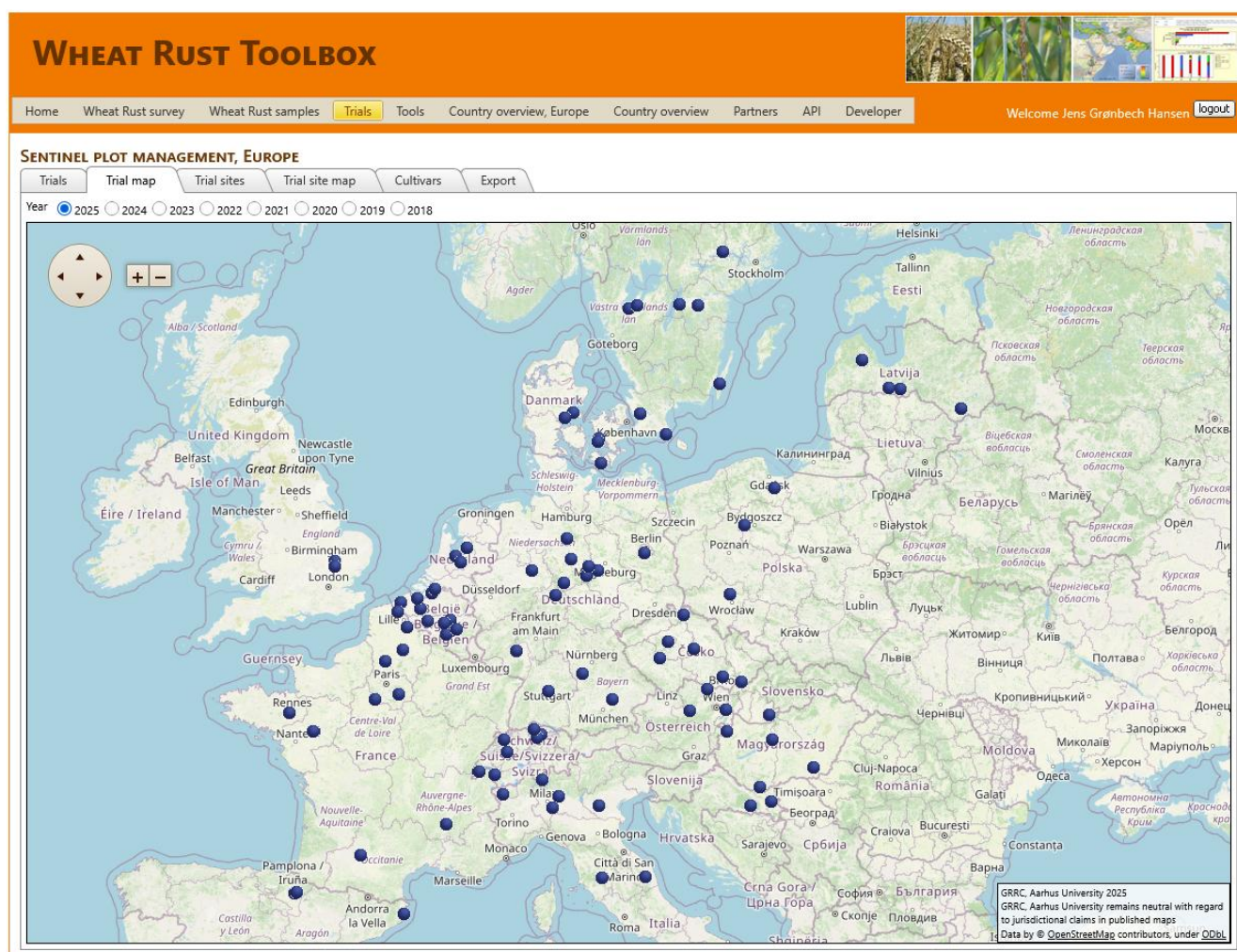
The Sentinel Plot Data Management System (SPDMS)

Documentation and user guide

Aarhus University,

Foulum, 30 October 2025

Jens G. Hansen & Valérie Cadot



Web site provided by Aarhus University, Faculty of Technical Sciences, Department of Agroecology.
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1. Introduction

The **Sentinel Plot Data Management System (SPDMS)** is a component of the **Wheat Rust Toolbox (WRT)**, designed for the management, analysis, and visualization of data from the VSCU wheat rust disease sentinel plot network. Disease severity is assessed in the field on twelve differential cultivars, while race phenotyping and genotyping of *Puccinia striiformis* (yellow rust), *P. triticina* (leaf rust), and *P. graminis f. sp. tritici* (stem rust) are conducted on isolates submitted to specialized diagnostic laboratories.

The differentials are sown at Value for Sustainable Cultivation and Use (VSCU) trial sites distributed across Europe. This differential set (sentinels) comprises twelve cultivars possessing key resistance genes conferring differential responses to the three major rust pathogens. This activity is conducted within the framework of the Horizon Europe **IPMorama** project (2024–2028).

Objective

To obtain an early indicator of new yellow rust (YR), leaf rust (LR) or stem rust (SR) virulence present in EU VSCU trials through field-based phenotyping of rust diseases, thereby enabling a more accurate interpretation of cultivar resistance performance. Isolates will be sampled, and races and genotypes will be diagnosed in diagnostic laboratories using genotyping (SSR markers) and pathotyping approaches. The obtained results will contribute to European mapping tools that visualises i) disease pressure from yellow rust, leaf rust and stem rust by scoring rust incidence and severity on locally susceptible cultivars at VSCU trial sites and ii) the evolution and spread of races and genotypes across Europe.

Output

The **SPDMS** is managed upon user login, by the VSCU network partners in collaboration with the IPMorama project and the **Global Rust Reference Center (GRRC)**. The system ensures data quality using standardized protocols, and the resulting outputs are visualized as interactive maps and charts within the Toolbox and across various websites targeting different end-user groups.

Outcome

The sentinel plots are established adjacent to, or integrated with, the fields used for official variety testing in the EU, conducted by VSCU. The interpretation of results will be enhanced by integrating knowledge of local wheat rust genotypes and phenotypes obtained through the sampling and characterization of isolates collected from the sentinel plots at the same trial sites. In this way, the VSCU network will contribute to the European early warning system for wheat rust diseases. The adoption of a common database system will strengthen collaboration, promote harmonization of methodologies, and enhance the robustness of results.

Report Summary

This report documents the development of the system and serves as a user guide for the specific tools and services provided. It relates to **Task 2.4** and **Deliverable 2.5** of the **IPMorama** project. Sincere thanks are extended to all VSCU-partners and wheat rust laboratories for their valuable contributions.

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Valérie Cadot manages the list of partners in the VSCU network, and she coordinates all activities.

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2. Methods

A VSCU guide was created by GEVES & Aarhus University for experimenters explaining the SPDMS running and 2 online trainings were delivered on this topic in May 2025.

The data collection is organized in close collaboration with the VSCU network in Europe. Seed for 12 differential cultivars is prepared by the Tystofte Foundation in Denmark and planted at VSCU trial sites across Europe.

The differential set consists of the following wheat cultivars: Mariboss, Ambition, Amboise, Gringo, Chevignon, Providence, Hyteck (Spontan, from 2026), KWS Extase, LG Armstrong, Kvium, Gladiator, and Sherif.

Virulence on Ambition (+/-) serves as a resistance component that distinguishes the Warrior and Warrior (-) races. Mariboss carries Yr15, and Chevignon and Amboise carries R-specificities that distinguish races within the PstS10 clonal group. Yr15 has been effective across all regions of Europe for more than 20 years and served in 2025 as a “diagnostic” marker for the advance of the Yr15-virulence in Europe. Thus, the observed disease patterns on the differentials may indicate evolutionary changes in the wheat rust populations at the spatial scale (Table 1).

Table 1. Differential cultivars (“Sentinels”) in the sentinel plots in 2025/2026. Mariboss; Ambition; Amboise; Gringo; Chevignon is planted for sampling YR isolates, Providence; Spontan; KWS Extase; LG Armstrong; Kvium for LR and Gladiator and Sherif for SR.

Rust sentinels	Yellow rust (YR)	Leaf rust (LR)	Stem rust (SR)
Mariboss	YR15		
Ambition	Race-specificity towards Warrior and related races		
Amboise	Race-specificity within PstS10 races		
Chevignon	Race-specificity within PstS10 races		
Gringo	Susceptible		
Providence		Lr28	
Spontan		Lr24, Lr28	
KWS Extase		Lr13, Lr14a, Lr37	
LG Armstrong		Lr24	
Kvium	Yr15	Susceptible	Susceptible
Sheriff			Sr24
Gladiator	Yr9		Sr31

Thus, the approach is “hunting the new”: send in a sample and find out what it is. If the sample represents something new, then alert all relevant stakeholders as a part of the European warning system.

2.1 Disease scoring and sampling

Score disease severity on the three upper leaves 2-3 times during the season (heading, flowering and Grain filling)

- Score YR, LR and SR disease on the 12 differentials. If there are other diseases, note this in the comment box

Additional cultivars in the trial:

- 1 Yellow Rust (YR) susceptible reference cultivar
- 1 Leaf Rust (LR) susceptible reference cultivar
- 1 Stem Rust (SR) susceptible reference cultivar.
- 3 local cultivars, own choice

The VSCU partners upload data via a webform in the Wheat Rust Toolbox including a sample code for each sample with a visual score, which is sent to a lab for genotype and /or race identification.

The link between the sample in a VSCU trial and the results of race phenotyping and /or genotyping will be the sample code affiliated with a sample sent for race phenotyping at GRRC, INRAE or another recognised lab.

For sending a sample to the labs, you must check sample and enter a sample code as a combination of: Country code, YYYY, User initials and sample number, e.g. ES2018ALA102. When the laboratory results are uploaded to the Pathogen database (using the same sample code), they will automatically become visible in the SPDMS as well. The results will be accessible through the web form used for entering the sample codes and passport data for isolates collected from the “sentinels” in a specific trial. VSCU-partners can download own data and see all results from the VSCU network on maps and charts.

2.2 RustWatch disease severity scale

For disease scoring the disease scale adopted by the RustWatch H2020 project was used. The level of 5% severity is used as the midpoint of the scale. In general, this is Max disease accepted by breeders and it is also a threshold for control with fungicides in many countries according to [EuroWheat](#). The same scale is used in the Wheat Rust Surveillance App developed for uploading disease surveillance and monitoring metadata from farmers' fields and experimental sites.

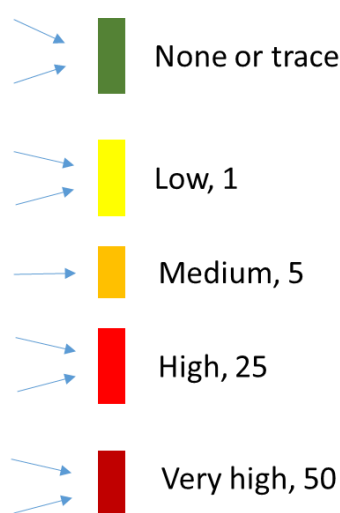
RustWatch
Disease severity scale

1-9 scale	Disease severity
1	0
2	0,1 (trace)
3	0,5
4	1
5	5
6	10
7	25
8	50
9	>75

RustWatch
Disease severity classes on maps

For:

- Disease on differentials
- Disease pressure



2.3 What is The Wheat Rust Toolbox?

To enter disease observations and sample codes the VSCU partners must login to the Wheat Rust Toolbox (WRT):

[Login to the Wheat Rust Toolbox](#)

The WRT is a data management, analysis and display system for global wheat rust data. It has been developed as a platform in previous projects, and its associated outputs and web tools can be found on websites such as:

- RustWatch (<https://agro.au.dk/forskning/projekter/rustwatch>)
- GRRC website (<http://wheatrust.org/>)
- EuroWheat (<http://agro.au.dk/forskning/internationale-platforme/eurowheat/>).

All data that has been quality controlled is publicly available via maps and charts on these information platforms. As part of the IPMorama project, new tools were developed and existing tools improved for data management within this project. Results from the IPMorama project are then able to be shared across platforms outside of the main project.

Isolates sampled are sent to dedicated labs for genotyping and race phenotyping e.g. GRRC at Aarhus University and the INRAE leaf rust lab. Each lab has its own space in the toolbox and associated staff upload, quality control and manage their own data. Once the data is ready for publication, one person-in-charge per lab moves the data to level 2 in the toolbox where the data will be available for an Expert panel. Once the data has been approved by the expert panel, the data can be moved to the public domain by the task leaders at the GRRC.

Isolates sampled via the Sentinel Plot Data Management System is an integrated part of this and the results from the VSCU trials are merged with results from national surveys, samples from experimental sites and displayed on the same maps and chart.

Authorized VSCU partners can login and have access to different parts of the system.

- VSCU partners can upload disease scorings on differential cultivars and reference cultivars susceptible to YR, LR and SR and see uploaded data from all trials on-the-fly on maps and in overview tables. They can edit their own primary data
- The Manager of the system (V. Cadot, GEVES) can generate new users with login, new trial sites and new trials. The manager can also download all primary data from all trials in one Excel file.

GRRC is responsible for the development and improvements of the Wheat Rust Toolbox – in collaboration with many BGRI, RustWatch and IPMorama partners.

3. Generating users, trial sites and trials

After login, the SPDMS manager has access to the Sentinel Plot Management page that includes six tab pages (Fig 1):

- Trials
- Trial Map
- Trial sites
- Trial site map
- Cultivars
- Export.

WHEAT RUST TOOLBOX

HomeWheat Rust surveyWheat Rust samplesTrialsToolsCountry overview, EuropeCountry overviewPartnersAPIDeveloper

Welcome Jens Grønbech Hansenlogout

SENTINEL PLOT MANAGEMENT, EUROPE

TrialsTrial mapTrial sitesTrial site mapCultivarsExport

Year
☒ 2025
☐ 2024
☐ 2023
☐ 2022
☐ 2021
☐ 2020
☐ 2019
☐ 2018

Generate trials for a selected year

Year for creating2026
Trial sites for creatingAll trial sites selected
Cultivar group for creatingRust Watch 1

Trial	Site	Country	Host genus	Host species	User	Replicates	Dates	Cultivars	Cultivar group		
2025_Fuchsenbigl_AGES_AT	Fuchsenbigl	Austria	Triticum	sp.	JGH	2	2	12	IPMorama 24_25		
2025_Grabeneegg_AGES_AT	Grabeneegg	Austria	Triticum	sp.	JGH	2	2	12	IPMorama 24_25		
2025_Schönfeld_AGES_AT	Schönfeld	Austria	Triticum	sp.	JGH	2	3	12	IPMorama 24_25		
2025_Acosse_OBEV-CRA-W_BE	Acosse	Belgium	Triticum	sp.	JGH	1	5	12	IPMorama 24_25		
2025_Enghien_OBEV-CRA-W_BE	Enghien	Belgium	Triticum	sp.	JGH	1	3	12	IPMorama 24_25		
2025_Gesves_OBEV-CRA-W_BE	Gesves	Belgium	Triticum	sp.	JGH	1	4	12	IPMorama 24_25		
2025_Hannut_OBEV-CRA-W_BE	Hannut	Belgium	Triticum	sp.	JGH	1	4	12	IPMorama 24_25		
2025_Leffinge_ILVO_BE	Leffinge	Belgium	Triticum	sp.	JGH	1	8	12	IPMorama 24_25		
2025_Merelbeke_ILVO_BE	Merelbeke	Belgium	Triticum	sp.	JGH	1	3	12	IPMorama 24_25		
2025_Mettet_OBEV-CRA-W_BE	Mettet	Belgium	Triticum	sp.	JGH	1	2	12	IPMorama 24_25		
2025_Poperinge_ILVO_BE	Poperinge	Belgium	Triticum	sp.	JGH	1	4	12	IPMorama 24_25		
2025_Terwagne_OBEV-CRA-W_BE	Terwagne	Belgium	Triticum	sp.	JGH	1	3	12	IPMorama 24_25		
2025_Thorembais_OBEV-CRA-W_BE	Thorembais	Belgium	Triticum	sp.	JGH	2	5	12	IPMorama 24_25		
2025_Warervliet_ILVO_BE	Warervliet	Belgium	Triticum	sp.	JGH	1	1	12	IPMorama 24_25		
2025_Kutina_CCAERA/MCDUS_MB	Kutina	Croatia	Triticum	sp.	JGH	1	0	12	IPMorama 24_25		
N = 97											

Observation date	Comment		
16. June 2025			
16. July 2025			
N = 2			

New trialNew trial date

Figure 1. Trap Nursery Management menu

The general steps in management are:

- Decide on the set of cultivars to be used.
- Obtain an overview of new trials.
- A trial site will remain unchanged if it is located within a 5 km radius of the site used for previous trials at that location.
- Update the list of users authorized to log in to the system.
- Inform the Tystofte Foundation where and when to send seeds for planting in late summer.
- The manager can create individual new trials, while the GRRC manager can generate all trials in a single step.
- Trial names will consist of a combination of the year, location name, institution acronym, and country code (Fig. 1).
- For each trial, the manager defines the number of replicates and selects the set of “sentinels” to be used. It is possible to define different cultivar sets for different trials, which is particularly relevant when changing between years.
- Export list of all samples taken in all trials indicating how many results are expected, motivate partners to do sampling in regions not yet covered by sampling IDs

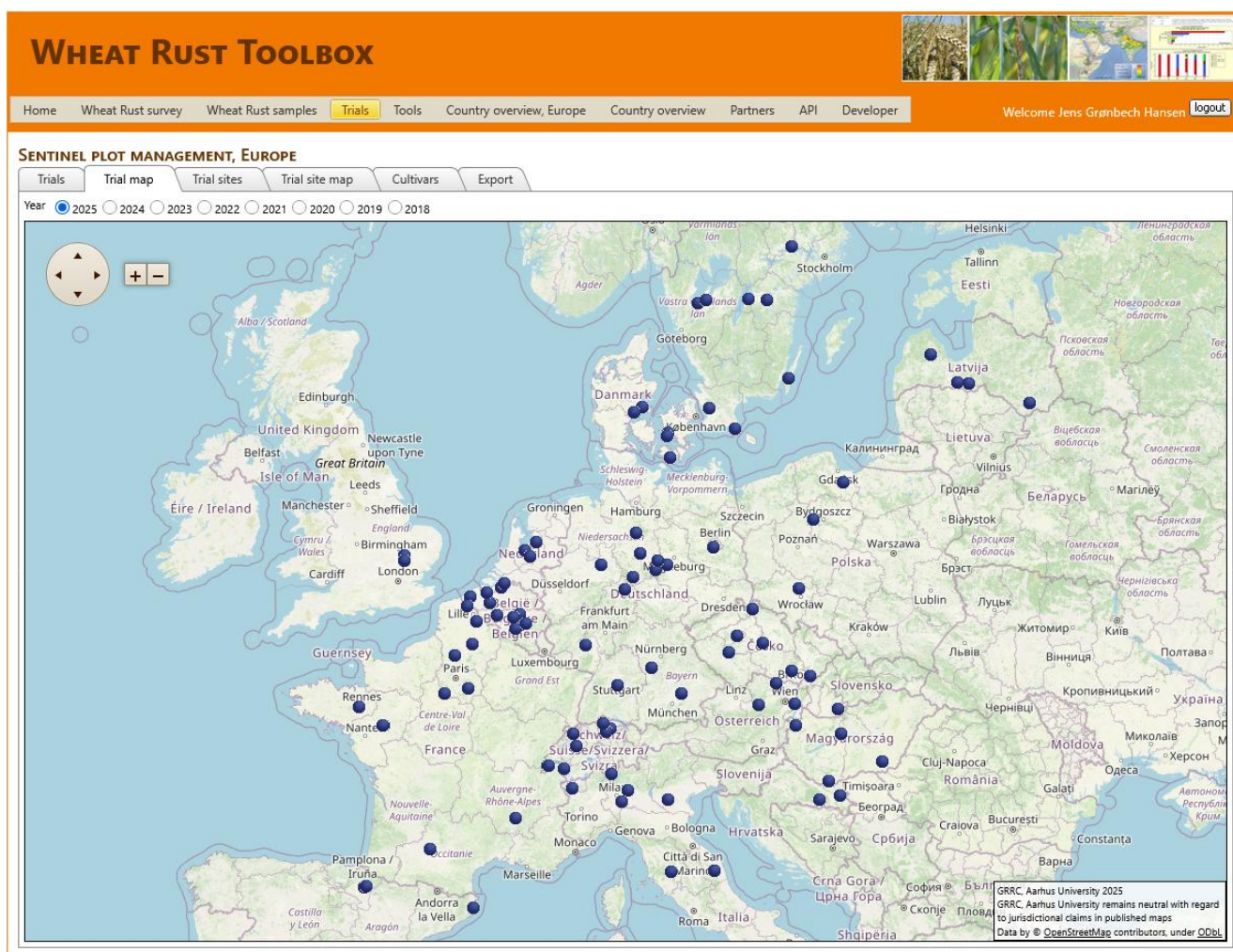


Figure 2. Trial map: Results from 58 trials out of 97 were uploaded, some with up to five scoring dates.

A trial site is identified by the following variables:

- Country,
- Responsible Institution
- Name (of the area or responsible experimental station / company)
- Geoposition (GPS latitude/longitude in decimal coordinates)
- Altitude

Only the system manager can create a new trial site (Fig. 3). Even if the exact location of a trial changes slightly (within a 5 km radius) between years, the same trial site name should be used. Once all trials have been defined, they will be displayed on the trial map (Fig. 2). Not all trial sites host a trial every year; therefore, the trial site map shows more trial sites than actual trial locations (Figs. 4 and 2).

Country	Institution	Name	Latitude	Longitude	Altitude	Selected		
Austria	AGES	Fuchsenbigl	48.19267	16.75275		☒		
Austria	AGES	Gerhaus	48.03585	16.85273		☒		
Austria	AGES	Grabeneegg	48.15115	15.25205		☒		
Austria	AGES	Schönfeld	48.76745	15.99093		☒		
Belgium	ILVO	Leffinge	51.15287	2.90839		☒		
Belgium	ILVO	Merelbeke	50.97521	3.76322		☒		
Belgium	ILVO	Poperinge	50.88696	2.78239		☒		
Belgium	ILVO	Warervliet	51.26471	3.63251		☒		
Belgium	OBEV-CRA-W	Acosse	50.59790	5.05268		☒		
Belgium	OBEV-CRA-W	Enghien	50.66337	4.06762		☒		
Belgium	OBEV-CRA-W	Enghien	50.67035	4.08419		☐		
Belgium	OBEV-CRA-W	Gembloux	50.61963	4.76010		☐		
Belgium	OBEV-CRA-W	Gesves	50.40948	5.10404		☒		
Belgium	OBEV-CRA-W	Hannut	50.67669	5.05915		☒		
Belgium	OBEV-CRA-W	Mettet	50.28116	4.85015		☒		
Belgium	OBEV-CRA-W	Ohey	50.39073	5.12526		☐		
Belgium	OBEV-CRA-W	Scy	50.30821	5.21698		☐		
Belgium	OBEV-CRA-W	Terwagne	50.43089	5.31180		☒		
Belgium	OBEV-CRA-W	Thorembais	50.60668	4.76259		☒		
Belgium	OBEV-CRA-W	Willauvois	50.56071	3.60417		☐		

N = 149

New trial site

Figure 3. Trial site tab. By July 2019, 101 Trial sites were implemented in the toolbox.

Trial names are generated based on a combination of Year, Trial site name, Responsible Institution and Country. Therefore, it is important that all trial sites have these four variables defined.

To generate new trials for a new year the Manager can select any trial site names via a drop-down list with checkmarks. Then trials for a news season can be generated automatically by the database (Fig. 4).

The definition and affiliation of cultivars in the Differential set are managed on the Cultivar tab (Fig. 5).

The data is uniform for differential set results, but each partner hosting a differential set can decide whether and how many local reference cultivars to add as indicators of the disease pressure of YR, LR and SR on that location. The names of the reference cultivars may differ between regions and countries.

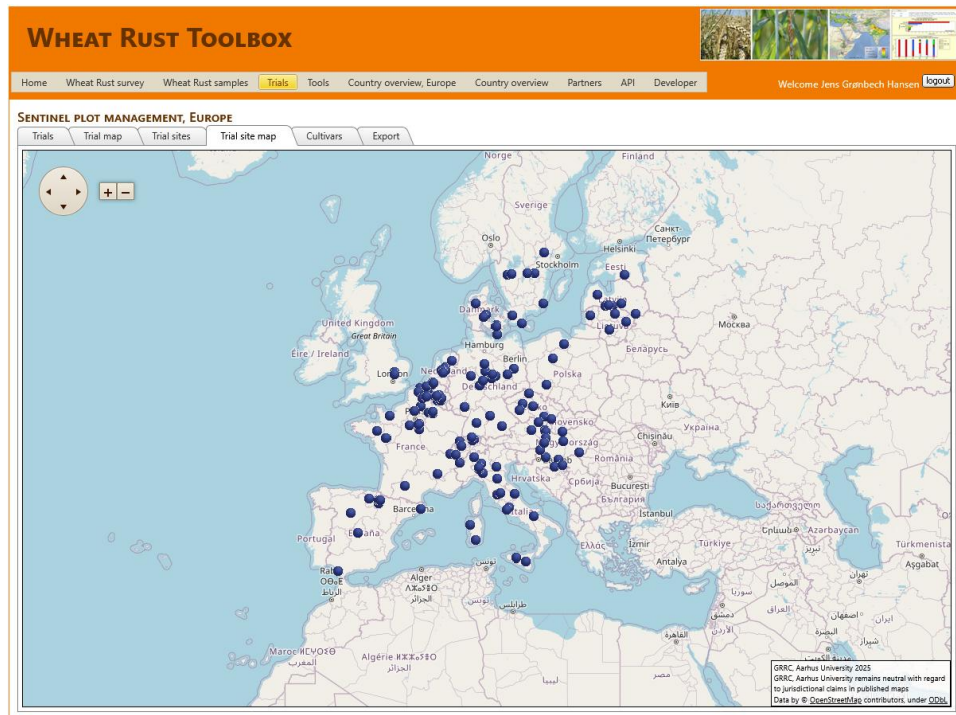


Figure 4. Trial site map.

WHEAT RUST TOOLBOX

Home Wheat Rust survey Wheat Rust samples **Trials** Tools Country overview, Europe Country overview Partners API Developer Welcome Jens Grambsch Hansen [logout](#)

SENTINEL PLOT MANAGEMENT, EUROPE

Trials Trial map Trial sites Trial site map **Cultivars** Export

GROUP			CULTIVAR			CULTIVAR		
Year	Cultivar group		Cultivar	Sorting	Image	Cultivar	Sorting	Image
2023	Rust Watch 1		Mariboss	1		Ambition	1	
2023	Rust Watch 2		Ambition	2		Spalding Prolific	2	
2025	IPMorama 24_25		Amboise	3		Compair	3	
2026	IPMorama 25_26		Gringo	4		Moro	4	
			Chevignon	5		Mariboss	5	
			Providence	6		Rendezvous	6	
			Spontan	7		Nemo	7	
			KWS EXTASE	8		Benchmark	8	
			LG ARMSTRONG	9		Amboise	9	
			Kvium	10		Gringo	10	
			Gladiator	11		Chevignon	11	
			Sheriff	12		Providence	12	
						Hyteck	13	
						KWS EXTASE	14	
						LG ARMSTRONG	15	
						Kvium	16	
						Gladiator	17	
						Sheriff	18	
						Spontan	19	

N = 4 N = 12 N = 19

[New cultivar group](#) [Connect cultivar to group](#) [New cultivar](#)

Figure 5. Cultivars tab. Management of Differential cultivars in the system – Names, sorting and colours. The differential set for 2025/2026 is selected (left). Diff cultivars selected for this set (middle) and the total set to select from to the right.

All disease scoring data can be exported to Excel (Fig. 6). Users can adjust the export settings for the CSV file to ensure that the data opens correctly in separate columns in their own Excel sheets (Fig. 7).

WHEAT RUST TOOLBOX

HomeWheat Rust surveyWheat Rust samplesTrialsToolsCountry overview, EuropeCountry overviewPartnersAPIDeveloper

Welcome Jens Grønbech Hansenlogout

SENTINEL PLOT MANAGEMENT, EUROPE

TrialsTrial mapTrial sitesTrial site mapCultivarsExport

Date formatdd.mm.yyyyField separatorSemicolonDecimal pointPoint

Year20252024202320222021202020192018

DiseaseSeptoriaSpot BlotchFusarium Head BlightWheat BlastYellow RustLeaf RustStem Rust

Export trial sites to CSV

Export trials to CSV

Export samples to CSV

Figure 6. Export tab.

Trial site	Institution	Country	Latitude	Longitude
Gerhaus	AGES	Austria	48,035845	16,852728
Grabenegg	AGES	Austria	48,151153	15,252051
Fuchsenbigl	AGES	Austria	48,192674	16,752753
Schönfeld	AGES	Austria	48,767447	15,99093
Mettet	OBEV-CRA-W	Belgium	50,28116	4,85015
Gesves	OBEV-CRA-W	Belgium	50,40948	5,10404
Terwagne	OBEV-CRA-W	Belgium	50,43089	5,311803
Acosse	OBEV-CRA-W	Belgium	50,5979	5,05268
Thorembais	OBEV-CRA-W	Belgium	50,60668	4,76259
Enghien	OBEV-CRA-W	Belgium	50,66337	4,06762
Hannut	OBEV-CRA-W	Belgium	50,67669	5,05915
Poperinge	ILVO	Belgium	50,886955	2,782388
Merelbeke	ILVO	Belgium	50,975211	3,763222
Leffinge	ILVO	Belgium	51,152866	2,908386
Warervliet	ILVO	Belgium	51,264712	3,632513
Kutjevo	CCAFRA/HCPHS	Croatia	45,386097	17,812897
Osijek	CCAFRA/HCPHS	Croatia	45,527617	18,6895
Uherský Ostroh	UKZUZ	Czech Republic	48,9904289	17,4190319
Brno Chrlice	UKZUZ	Czech Republic	49,1247219	16,6341669
Vysoká u Příbrame	UKZUZ	Czech Republic	49,6341669	13,9525
Čáslav Filipov	UKZUZ	Czech Republic	49,902221	15,414721
Prague - Ruzyně	VURV	Czech Republic	50,084851	14,300533
Chrastava	UKZUZ	Czech Republic	50,8175	14,9586111
Holeby	TystofteFonden	Denmark	54,720042	11,4614
Skælskør	TystofteFonden	Denmark	55,2419	11,3142
Flakkebjerg	TystofteFonden	Denmark	55,318226	11,383329
Sejet	TystofteFonden	Denmark	55,819877	9,927283
Dyngby	TystofteFonden	Denmark	55,950498	10,25283
Monbequi	CTPS-R2n	France	43,890258	1,22864
Etoile sur Rhône	CTPS-Arvalis	France	44,8291	4,8741
Erdre-en-Anjou-2	CTPS-GEVES	France	47,563008	-0,825761
Erdre en Anjou-VATE	CTPS-GEVES	France	47,588388	-0,749976
Le Rheu	CTPS-INRA/GEVES	France	48,1083	-1,797222

Figure 7a. Trial sites – 103 in October 2025

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Figure 7b. Disease scorings by Trial name. 12 Diff cultivars with known resistances, 3 reference susceptible cultivars (YR, LR and SR) with no effective resistance and 3 local (mega) cultivars by own choice.

Figure 7c. Sample codes and passport data for samples sent to designated labs for characterisation. When results of genotyping and race phenotyping is uploaded to the database then the genotype name and / or the race name will appear in column H and I respectively

On the submenu User management, the manager controls and Edits the list of users. The manager can make a new user – select the button “New user”. A list with all users including e-mails can be exported to Excel – Select the button Export to CSV.



Init	Alternative ID	Firstname	Lastname	Institution	Department	Country	E-mail	Active	
JRA		Julian Rodriguez	Algaba	Aarhus University	Department of Agroecology	Denmark	julianr.algaba@agro.au.dk	☒	
SAM		Soukaina	Amazdo	GEVES		France	soukaina.amazdo@geves.fr	☒	
NAR		Nerea	Arias Fariñas			Spain	narias@intiasa.es	☒	
JAU		Jérôme	Auzanneau	AGRI- OBTENTIONS		France	jerome.auzanneau@agri-obt	☒	
AAV		Auberi	Avalle	Unisigma	Oise	France	a.avalle@unisigma.com	☒	
BBA		Biruta	Bankina	Latvia University of Agriculture		Latvia	biruta.bankina@llu.lv	☒	
TBA		Tommaso	Bardelli	CREA-DC		Italy	tommaso.bardelli@crea	☒	
SBA		Solene	Barrais	GEVES		France	solene.barrais@geves.fr	☒	
CBR		Caroline	Breidenbach			Germany	caroline.breidenbach@julius	☒	
KBU		Katarína	Bučková	UKSUP Sk.		Slovakia	Katarina.Buckova@uksup.sk	☒	
ACA		Amaia	Caballero	INTIA	DIVISION ITG	Spain	acaballero@intiasa.es	☒	
VCA		Valérie	Cadot	GEVES		France	valerie.cadot@geves.fr	☒	
HCO		Hilmar	Coester	RAGT 2N		Germany	HCoester@ragt.fr	☒	
HDA		Huw	Davis	NIAB		Great Britain	huw.davis@niab.com	☒	
PDE		Paolo	De Franceschi	SIS		Italy	p.defranceschi@sisonweb.cc	☒	
RDE		Romain	DELEMME	Lemaire Deffontaines		France	r.delemme@lemaire-deffont	☒	
GDE		Gerhard	Deneken	Tystofte Foundation		Denmark	gde@tystofte.dk	☒	
CDE		Christine	Despesse	Arvalis Institut du Végétal		France	C.DESPESSE@arvalis.fr	☒	
LDR		Luka	Drenjancevic	HAPIH		Croatia	luka.drenjancevic@hapih.hr	☒	
LDU		Laure	DUCHALAIS	Anri-Obtentions		France	laure.duchalais@anri-obtent	☒	

N = 93

New user

Export to CSV

Field separator Comma

Figure 8. Overview of users in the system. Currently 93 people are partners that can upload data.

4. Input of disease severity data and sample code

When a user logs into the toolbox, the system will know i) if this user is affiliated with the Sentinel Plot Data Management System and 2) which country the user comes from.

Only trials from this country are then made available in the drop-down list of trials to select from.

First time:

- Select your trial name in the drop-down list. This list will only contain trial names from the country you are affiliated with.
- Enter the name for a local YR susceptible cultivar to be used for indication of the local disease pressure.
- Similar for a susceptible LR cultivar.
- Similar for a susceptible SR cultivar.

Steps entering disease observations:

- Select number of replicates in your trial
- Click New date
- Select disease level from drop down. If no disease then the default is zero (0) in the list. Then just leave it as it is.
- If samples were taken for genotyping and /or race phenotyping then checkmark "Sample" for the cultivar that the sample was taken from
- Select the button samples and enter the sample code for each sample taken and Passport information as well.
- Select the comment button and enter information if any other diseases dominated in the Diff cultivars or any other relevant information
- Select the button Save to save all entered information!!

As an example, at Lelystad, 2025 (Fig. 9), a set of the twelve differential cultivars was planted. YR was found on Ambition and Spalding Prolific at trace level. LR was recorded and sampled on Ambition, Amboise, Providence, Kvium and KWS Extase. YR was found at 25% severity on LG Armstrong. No stem rust in the Trial on that date, 17 June.

WHEAT RUST TOOLBOX

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SENTINEL PLOT INPUT, EUROPE

Observations

Date format Field separator Decimal point

Year ☒ 2025 ☐ 2024 ☐ 2023 ☐ 2022 ☐ 2021 ☐ 2020 ☐ 2019 ☐ 2018

Trial Replicates Observation date

Upload

DISEASE SEVERITY IN DIFFERENTIALS

Date	Incl.	Cultivar	Color	Sort	SR Severity Rep. 1	SR Sample Rep. 1	LR Severity Rep. 1	LR Sample Rep. 1	YR Severity Rep. 1	YR Sample Rep. 1
17. Jun	☒	Ambition		1	0%	☐	1%	☒	0%	☐
	☒	Mariboss		5	0%	☐	0%	☐	0%	☐
	☒	Amboise		9	0%	☐	1%	☒	0%	☐
	☒	Gringo		10	0%	☐	0%	☐	0%	☐
	☒	Chevignon		11	0%	☐	0%	☐	0%	☐
	☒	Providence		12	0%	☐	50%	☒	0%	☐
	☒	Hyteck		13	0%	☐	0%	☐	0%	☐
	☒	KWS EXTASE		14	0%	☐	25%	☒	0%	☐
	☒	LG ARMSTRONG		15	0%	☐	0%	☐	25%	☒
	☒	Kvium		16	0%	☐	50%	☒	0%	☐
	☒	Gladiator		17	0%	☐	0%	☐	0%	☐
	☒	Sheriff		18	0%	☐	0%	☐	0%	☐

DISEASE SEVERITY IN LOCAL CULTIVARS

Date	Incl.	Cultivar	Name	Color	Sort	SR Severity Rep. 1	SR Sample Rep. 1	LR Severity Rep. 1	LR Sample Rep. 1	YR Severity Rep. 1	YR Sample Rep. 1
17. Jun	☒	YR Ref. Susc.			1	0%	☐	0%	☐	0%	☐
	☒	LR Ref. Susc.			2	0%	☐	0%	☐	0%	☐
	☒	SR Ref. Susc.			3	0%	☐	0%	☐	0%	☐
	☐	Local 1			4	0%	☐	0%	☐	0%	☐
	☐	Local 2			5	0%	☐	0%	☐	0%	☐
	☐	Local 3			6	0%	☐	0%	☐	0%	☐

Figure 9. Data uploaded from Lelystad, NL 2025.

5. Visualisation of results

On the Trap nurseries / Trap nursery output submenu is the Trial output page with three tabs:

- Severity map
- Severity table
- Trial site map.

These tabs are available for all trap nursery users after login; for instance, the severity map (Fig. 10).

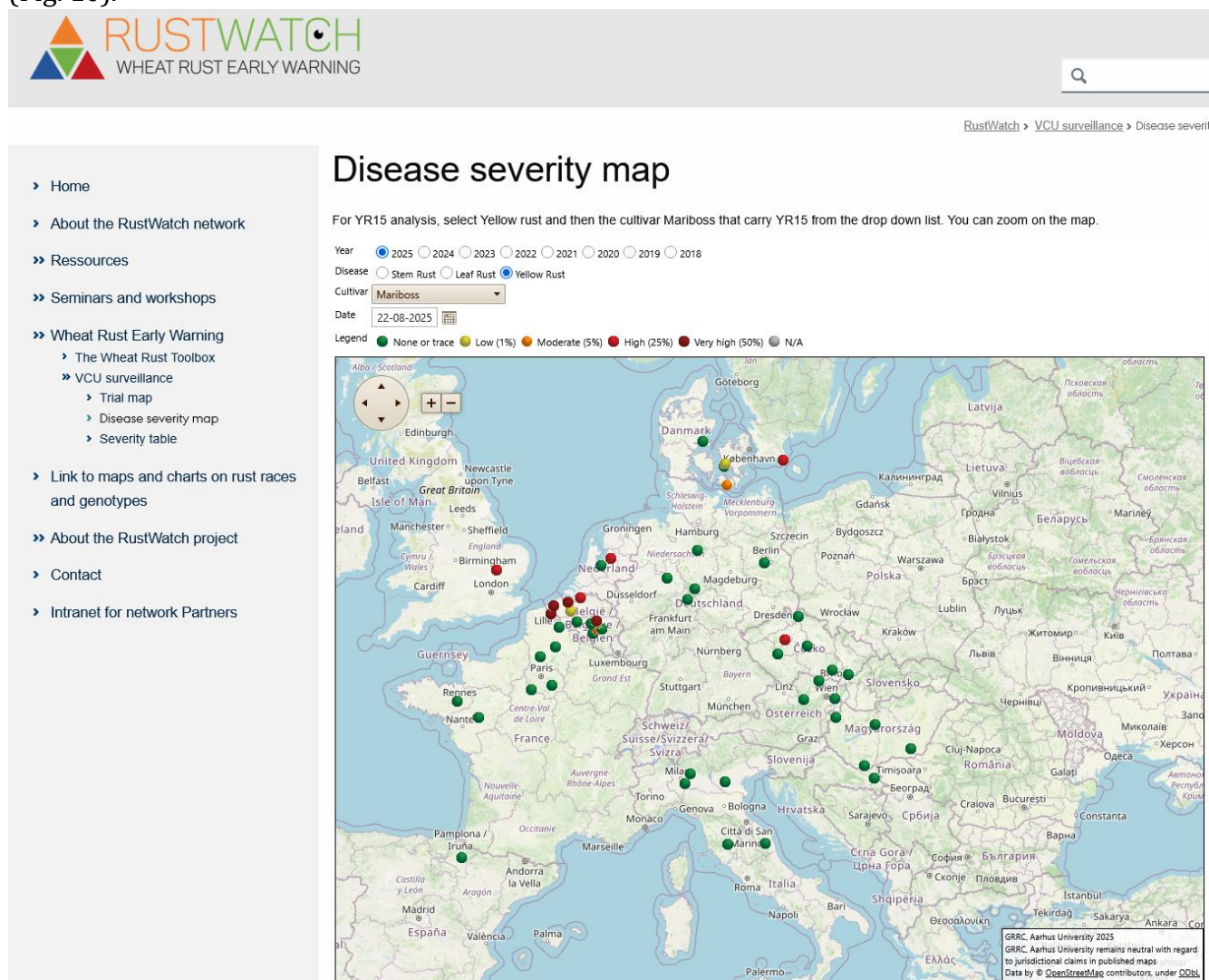


Figure 10. Severity map. Selected year 2025, cultivar Mariboss, and date August 22. The map displays the disease level for cultivar Mariboss on the date closest to the one selected.

How to do:

1. Select year
2. Select the cultivar for which you want to display data
3. Select a date (latest scoring dates are typically in May or June).

You can select one of the twelve differentials, but additionally:

- Yellow Rust susceptible cultivar
- Leaf Rust susceptible cultivar
- Stem Rust susceptible cultivar.

Each local host selected one or more local susceptible reference cultivars to indicate the local disease pressure for YR, LR and SR. Thus, the data points will indicate disease on a susceptible local cultivar, but the cultivars will be different between locations across Europe.

On the Severity table tab, results on all differential and reference cultivars by trial can be sorted by country and by up to three differentials. The colours indicate the maximum disease level of YR on differentials (first seven cultivars from the left), and SR on one or more SR susceptible cultivars, LR on one or more LR susceptible cultivars and YR on one or more YR susceptible cultivars (Fig. 11).

A future improvement could consist in classifying disease patterns on differentials into disease reaction profiles allowing quick indication of new yellow rust variants.

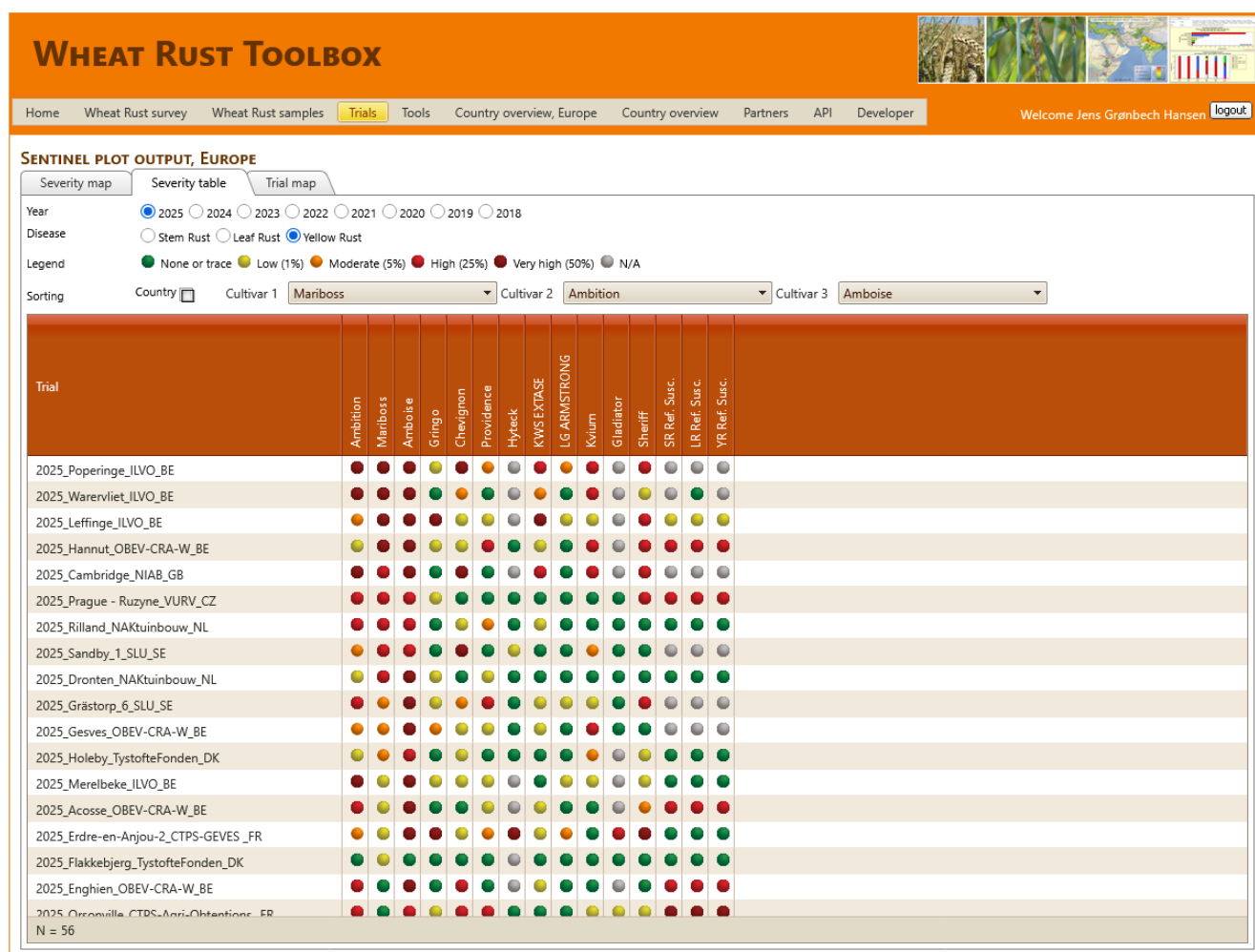


Figure 11. Severity table. Results on all differentials and reference cultivars by trial can be multiple sorted by country and up to three of the differentials. In this example sorted by Mariboss to indicate trials with isolates carrying YR15 virulence detected. From the Trial name you can recognise the Year, location name, Institution responsible and the Country name.

6. Link between disease observation at VSCU trial sites and genotype and race results

The SPDMS is linked via the sample codes from the VSCU trap nursery system with the genotype and race results in the Samples tables of the database. The implications will be, that the genotype and race results can be filtered and shown on maps and in tables for each VSCU trial. The combined data will feed into the Task 2.8, development of Risk management tool for wheat rust diseases in Europe.

7. Appendix - Database documentation

DATABASE DOCUMENTATION

Rust trials

TRIAL				
Field	Type	Size	Obligatory	Options
TrialAppID	Integer		Yes	-9: N/A 1: Trap Nursery 2: Skimmelstying 3: EuroWheat 4: EucaBlight 5: IPM Blight 2.0 6: Wheat Rust Toolbox
TrialID	Integer		Yes	
TrialName	String	100		
PublishedLevel	Integer			0: Unpubl. 1: Country 2: Project 3: Expert 4: Supplier 9: All
PublishedAllDate	Date			
PublishedAllUserInit	String	3		
TrialDescription	String	1073741823		
TrialSiteID	Integer			
HostGenusID	Integer			
HostSpeciesID	Integer			
HostFormalID	Integer			
HostCultivarName	String	50		
UserInit	String	3		
TrialYear	Integer			
Replicate	Integer			
ReferenceTreatmentID	Integer			
DifferentialSetID	Integer			
ColorStr	String	10		
Color	Integer			
MapPositionX	Integer			
MapPositionY	Integer			
Published	Boolean			True False
ModelFirstDateID	Integer			
ModelLastDateID	Integer			

TRIAL SITE				
Field	Type	Size	Obligatory	Options
TrialSiteID	Integer		Yes	
TrialSiteName	String	50		
InstitutionName	String	100		
TrialAppID	Integer			-9: N/A 1: Trap Nursery 2: Skimmelstying 3: EuroWheat 4: EucaBlight 5: IPM Blight 2.0 6: Wheat Rust Toolbox
CountryID	String	2		
RegionID	Integer			
Latitude	Decimal			
Longitude	Decimal			
Altitude	Decimal			
MapPositionX	Integer			
MapPositionY	Integer			
Selected	Boolean			True False

TRIAL DATE				
Field	Type	Size	Obligatory	Options
TrialAppID	Integer		Yes	-9: N/A 1: Trap Nursery 2: Skimmelstying 3: EuroWheat 4: EucaBlight 5: IPM Blight 2.0 6: Wheat Rust Toolbox
TrialID	Integer		Yes	
TrialDateID	Integer		Yes	
ObservationDate	Date			
Comment	String	1073741823		

CULTIVAR				
Field	Type	Size	Obligatory	Options
CultivarID	Integer		Yes	
CultivarName	String	50		
TrialAppID	Integer			-9: N/A 1: Trap Nursery 2: Skimmelstying 3: EuroWheat 4: EucaBlight 5: IPM Blight 2.0 6: Wheat Rust Toolbox
PathogenGenusID	Integer			
PathogenSpeciesID	Integer			
CultivarTypeID	Integer			1: Differential 2: Mega 3: Local 4: Check cultivar
Gene	String	25		
GeneList	String	50		
Origin	String	100		
Source	String	50		
ColorID	Integer			
SortOrder	Integer			

CULTIVAR OBSERVATION				
Field	Type	Size	Obligatory	Options
TrialAppID	Integer		Yes	-9: N/A 1: Trap Nursery 2: Skimmelstying 3: EuroWheat 4: EucaBlight 5: IPM Blight 2.0 6: Wheat Rust Toolbox
TrialID	Integer		Yes	
TrialDateID	Integer		Yes	
CultivarID	Integer		Yes	
ReplicateID	Integer		Yes	
DiseaseID	Integer		Yes	1: Stem Rust 2: Leaf Rust 3: Yellow Rust
SeverityPercentID	Integer			
SampleCollected	Boolean		Yes	True False
SampleCode	String	100		
SampleTypeID	Integer			
CollectorName	String	100		
InstitutionName	String	100		
GrowthStageID	Integer			

LOCAL CULTIVAR				
Field	Type	Size	Obligatory	Options
TrialAppID	Integer		Yes	-9: N/A 1: Trap Nursery 2: Skimmelstying 3: EuroWheat 4: EucaBlight 5: IPM Blight 2.0 6: Wheat Rust Toolbox
TrialID	Integer		Yes	
LocalCultivarID	Integer		Yes	
LocalCultivarName	String	50		
StandardCultivarID	Integer			
ColorID	Integer			
DiseaseID	Integer		Yes	1: Stem Rust 2: Leaf Rust 3: Yellow Rust
SortOrder	Integer			

LOCAL CULTIVAR OBSERVATION				
Field	Type	Size	Obligatory	Options
TrialAppID	Integer		Yes	-9: N/A 1: Trap Nursery 2: Skimmelstying 3: EuroWheat 4: EucaBlight 5: IPM Blight 2.0 6: Wheat Rust Toolbox
TrialID	Integer		Yes	
TrialDateID	Integer		Yes	
LocalCultivarID	Integer		Yes	
ReplicateID	Integer		Yes	
DiseaseID	Integer		Yes	1: Stem Rust 2: Leaf Rust 3: Yellow Rust
SeverityPercentID	Integer			
SampleCollected	Boolean		Yes	True False
SampleCode	String	100		
SampleTypeID	Integer			
CollectorName	String	100		
InstitutionName	String	100		
GrowthStageID	Integer			