

Newsletter (December 2022)

INVITE – INnovations in plant Variety Testing in Europe



Duration:
5 years



29 partners
13 countries



EU funded budget
8 Mio Euros



10 crops



INTRODUCTION BY FRANCOIS LAURENS

In the context where agriculture is increasingly being urged to reduce its dependency on external inputs, lower its environmental footprint and cope with more variable climatic conditions, the **INVITE** project aims to recommend new tools and approaches in plant variety testing to better assess sustainability and resilience of new varieties to various and changing environmental conditions.

INVITE combines scientific and technical expertise spanning a wide range of disciplines from e.g. plant physiology, variety testing, agronomy, genetics, breeding, biostatistics, bioinformatics, modelling, and economics. The project promotes innovation in plant variety testing by producing and disseminating targeted information to researchers, plant breeders, variety examination offices (EOs), advisory services, and farmers.

After a difficult first period hampered by the COVID-19 but also by the difficulties to access historical data, and thanks to the willingness, responsiveness and the hard work of all the members of the consortium, all the activities in the second period have been performed as planned. These activities include experiments in the field, in the greenhouse and in the lab, the development of numerical and genotypic tools, as well as the analysis of historical data thanks to the mixed models which start to produce very encouraging results.

After a few annual meetings held remotely due to the COVID-19 pandemic, we were able to organise our first annual meeting in person in Vienna in spring 2022. This was an excellent opportunity for the consortium to meet, exchange and learn concretely about all scientific and practical outputs of **INVITE**. It is also interesting to notice the attractiveness of the **INVITE** project through the collaboration we developed with other EU projects and communities that are interested and linked with the topics developed in **INVITE**. With the first results coming, the dissemination and valorisation of the results have significantly increased. We will carry on this trend in the next period and develop even more contacts with our stakeholders to exchange with them about the impacts of the project.

We look forward to a new year of fruitful collaborations and new results.
Wishing you all the best,

François Laurens, INRAe, Project Coordinator



INVITE at a glance

The Project “Innovations in plant Variety Testing in Europe » (INVITE) is funded by the EU under the H2020-SFS-2018-2 Call. The INVITE consortium comprises a total of 29 Partners, including 14 research institutions, 10 examination offices and post-registration organisations, and four industry partners.

LEARN MORE ABOUT OUR INVITE CONSORTIUM

www.h2020-invite.eu/partners/

For 60 months of activities, from July 2019 to June 2024, the project aims to improve both the efficiency of variety testing and the introduction available to stakeholders on variety performance under a range of production conditions and biotic and abiotic stresses. **INVITE** works on ten different species representing the main features of propagation, food and feed uses, and representing important breeding activities in Europe.



The project aims at engaging on a large scale with stakeholders in the co-creation and adoption of innovations and services to end-users involving awareness-raising, new policy initiatives and deployment.

Watch the video introducing the project. **[CLICK HERE](#)**

This newsletter and updates on the project website (www.h2020-invite.eu) will keep you updated on the project’s progress.





INVITE annual meeting

INVITE's third annual meeting took place in Vienna 19-21 April 2022, in the premises of AGES. This was the first face-to-face meeting since the kick-off meeting in 2019, due to the COVID-19 pandemic. 96 participants, representing the full consortium, participated in this 3-day event, which was both an opportunity to physically meet again, and also to present and discuss the first results obtained during the project so far.

The meeting started in the afternoon of 19 April, with a welcome and introduction by the Project Coordinator Francois Laurens (INRAE) and a presentation of the activities related to Communication and Dissemination. This was followed by parallel work package sessions, as well as a presentation on WP7 database management and interoperability, and a discussion on the added value of sharing VCU data at project level. In the evening, the meeting participants had the chance to meet and enjoy each other's company during a tour in the centre of Vienna and during dinner.

The meeting's second day started with parallel crop sessions in the morning, while progress and results thus far were presented for all the remaining Work Packages in the afternoon.

INVITE technoshow

In connection to the annual meeting in Vienna in the premises of AGES, a Technoshow was organised to showcase phenotyping tools developed for variety testing in the context of WP2.



Watch a video from the event [here](#).



Other news and events

The sections below present some of the deliverables and activities that have been carried out or taken place during the past 2 years.

COST-BENEFIT ANALYSIS FOR LOW-COST SENSORS TO DECIDE THE BEST TECHNOLOGIES TO BE VALIDATED IN WPs 5 AND 6

● This deliverable focused on the selection and deployment of low-cost sensors for a small set of crops of major interest in food production. Creating a general sensor for phenotyping is challenging due to the huge variety of traits to be measured in variety testing, however, it could lead to increased efficiency. Therefore, a survey of examiners was conducted to determine a selection of traits useful to examiners. Subsequently, machine vision algorithms were created using high quality data, and the data was degraded to compare the performance of the algorithms.

A minimum reasonable resolution was determined, and a table of useful low-cost cameras was elaborated. Finally, a rationale on the selection of the most promising traits to benefit from cost-effective phenotyping sensors was developed. It should be noted that while similar cameras can be used for similar phenotyping, each specific trait can be different. The goal with this deliverable is to show variety testers in the examination offices that these tools are available and may imply several advantages.

Figure 1. Example image of segmented tomato crate.





CORRELATIONS BETWEEN ROOT, YIELD STABILITY AND PLANT PHYSIOLOGICAL TRAITS AS A RESPONSE TO DROUGHT STRESS (IRTA)

(Please note that this deliverable has not yet been approved by the European Commission)



One-year field trials were conducted under irrigated and rainfed conditions with 22 wheat varieties, where the same varieties were characterised for root traits in the field and under controlled conditions. A positive correlation between root length and grain yield could be identified, indicating the potential of easy-to-measure root traits as bio indicators of drought adaptation. Additional testing will be done to confirm the stability of these bioindicators that will subsequently be presented in deliverable D1.4.


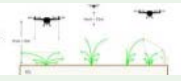





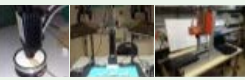


Figure 2. Aerial picture of Gréoux les Bains platform in 2021 on the left and IRTA trials in Sucs- Lleida in Spain 2021 on the right.

“SHOPPING LIST”, “DO IT YOURSELF CUSTOM LIST”, AND MEASUREMENT PROCEDURE TO GUIDE EOs AND PROs IN THE IMPLEMENTATION OF THE TWO NON RGB LOW-COST PHENOTYPING TOOLS (CRA)

(Please note that this deliverable has not yet been approved by the European Commission)

A list of protocols has been developed and tested during the project’s two first years in task 2.4 of WP2. This task aims to deliver new tools exploring beyond the human eye spectrum for specific traits of interest not accessible with regular RGB imaging devices. A number of tools have been delivered and are presented in five study cases, including 10 protocols (one per device), all following the same template structure outlining the purpose of the protocol, the requirements needed, the steps to follow before sample analysis and instructions for the analysis itself. Finally, recommendations are provided for exporting and storing data explanations on the data treatment flow applied on the acquired data in order to produce a result. The protocols are available for partners from the examination offices or post registration organisations to be tested and validated. This will be done in the context of task 5.1 in the WP5.

Deliverable 2.2: « Shopping list », « Do it yourself custom list »

- 
Protocol dedicated to the height of rye grass in plot trials using
 - > Photogrammetry technology on UAV (ONRAE Lisignan)
- 
Protocol dedicated to the numbering of apples on trees using
 - > Lidar technology on groundbased platform (INRAE Montpellier)
- 
Protocol dedicated to the quality of apples using
 - > Visible – NIR spectrometer (CRA-W)
- 
Protocol dedicated to fusarium detection on wheat in lab using
 - > Visible – NIR spectrometer in laboratory (CRA-W)
 - > Multispectral imaging in laboratory (GEVES)
 - > Hyperspectral imaging in laboratory (CRA-W)
- 
Protocol dedicated to fusarium detection on wheat in field using
 - > Multispectral imaging in field using a ground based support (GEVES)
 - > Hyperspectral imaging in field using a rotating stage (CRA-W)
 - > Hyperspectral imaging in field using a translation stage (CRA-W)
 - > Fluorescence in field (AGROSCOPE)



DATASET OF DUS AND VCU TRIALS WITH LOW-COST SENSORS AND STANDARD REFERENCE MEASUREMENTS (GEVES)

(Please note that this deliverable has not yet been approved by the European Commission)

This deliverable focused on the clustering of sets or sequences of images to form a dataset of DUS and VCU trials with low-cost sensors and standard reference measurements that will subsequently be used in D2.4 and D2.5. The choice of images was driven by a rationale collectively developed by the partners on the selection of the most promising traits to benefit from cost-effective phenotyping sensors. New image sets and sequences acquired in 2021 are being validated and



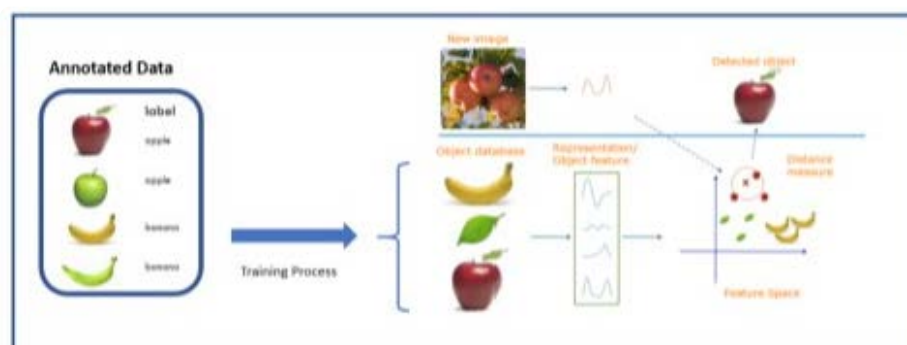
will integrate the dataset, while contributing to the production of D2.4 and D2.5. This deliverable will also allow for Task 2.3 to implement machine-learning techniques for images annotation and the assessment of manual measurements to understand whether they can be replaced by measurements with image acquisition and analysis.

Figure 3. Apple segmentation on a sorting machine

ANNOTATION OF THE DATASET OF DUS AND VCU TRIALS WITH LOW-COST SENSORS AND STANDARD REFERENCE MEASUREMENTS (INRA) DAVID ROUSSEAU

(Please note that this deliverable has not yet been approved by the European Commission)

This deliverable consisted of annotated versions of some of the data sets provided in D2.3, to be further used to train the models delivered in D2.5. The annotated data sets were used to train machine learning models as further described in D2.5. In addition to the annotation, efficient tools for annotation were also identified that could be reused by partners to increase the number of images or to address the variety testing traits.





In the last months, INVITE was showcased at various events, such as congresses, exhibitions, webinars and more, addressing various types of audiences. Here is an overview of some of them:

▶ WEBINAR “ROBOTICS, AI, AR FOR DIGITAL PHENOTYPING AND VARIETY SCREENING: A DATA-DRIVEN APPROACH”

In this webinar recorded in December 2020 Rick van de Zedde (WUR), co-leader of WP2, discussed emerging technologies such as automated plant phenotyping, that offers plant scientists, breeders and growers a powerful tool to gather vast amounts of growth data to understand and optimise plant performance and productivity. He also explained the focus of the WP2 in which on the one hand a list of useful traits for a range of crops is selected used in DUS and VCU variety tests that might be suitable to automated screening, while on the other hand a list of tools and algorithms is proposed that offer proof how these selected traits can be measured in a data driven and affordable manner. The webinar is available [here](#).



▶ NUIT EUROPÉENNE DES CHERCHEURS 2021



The 2021 edition of the Nuit Européenne des Chercheurs was dedicated to “Travelling”. David Rousseau (Univ Angers), WP2 leader, took the opportunity to talk about how his team is revisiting optimal transport to address distinctness in variety testing and in **INVITE** project specifically. The video (in French) is available [here](#) (the part on **INVITE** starts at 17 min 52 seconds).

▶ CAPTE WORKSHOP

Arvalis, together with INRAE and HIPHEN, organised a 2-day workshop in May 2022 in Avignon. The **CAPTE workshop** aimed at celebrating achievements in the development of plant phenotyping tools and methods and fostering discussions on the next steps of plant phenotyping research under field conditions. The workshop was followed by a visit to the Gréoux-Bains experimental station where several high-throughput field phenotyping systems are operated on a regular basis.





▶ INVITE AT THE EUROSEEDS 2022 CONGRESS

At the Euroseeds 2022 Congress which attracted more than 1200 participants, Euroseeds presented the **INVITE** project on various occasions: during a presentation on communicating innovation through involvement in the EU-funded research projects where the importance of communication and dissemination activities was highlighted and at the Euroseeds booth where dissemination material was available for those interested to learn more about research projects, and in a **Giant Views interview for European Seed**.



News from the field/lab

▶ AGES FIELD TRIAL VIDEOS

The Austrian examination office AGES has produced three videos (in German) presenting the **INVITE** project and AGES field trial activities in 2021, specifically on wheat and perennial ryegrass clover.

The videos are available on **INVITE YouTube channel**.



INVITE wheat trials

22 views • 11 months ago



INVITE perennial ryegrass clover trial

21 views • 11 months ago



▶ PROGRESS ON SEMI-AUTOMATED TOMATO DUS SCORING

DUS testing on tomatoes is based on 61 different traits, including morphological traits of the plant; a variety of traits of both the inside and the outside of the fruit; and resistance to a wide variety of parasites and diseases. **INVITE** WP2 has explored the possibility of automation for the DUS trait scoring of three of those traits, namely fruit size, fruit shape ratios, and peduncle scar size, through the use of a mobile imaging system, featuring a stabilized RealSense D415 stereo depth camera.

Read a more detailed overview [here](#).



▶ TESTS AT ARVALIS PHÉNOFIELD PLATFORM



In the framework of **INVITE** and MaxRoot-C projects, Agroscope and Thünen-Institut partners visited the Arvalis PhenoField platform. Various samples were taken to assess the impact of lack of water at early stage on roots colonisation and the varietal adaptive capacities.





Publications

David Rousseau and his team, from the University of Angers in France, have released three publications presenting findings and conclusions of their research conducted in the context of INVITE.



Garbougé, H., Rasti, P., & Rousseau, D. (2021).
Enhancing the Tracking of Seedling Growth Using RGB-Depth Fusion and Deep Learning. *Sensors*, 21(24), 8425.
[Link to the document](#)



Zine-El-Abidine, M., Dutagaci, H., & Rousseau, D. (2021, August).
Dimensionality Reduction for Ordinal Classification.
In 2021 29th European Signal Processing Conference (EUSIPCO) (pp. 1531-1535). IEEE.
[Link to the document](#)



Couasnet, G., El Abidine, M. Z., Laurens, F., Dutagaci, H., & Rousseau, D. (2021).
Machine learning meets distinctness in variety testing. In Proceedings of the IEEE/CVF International Conference on Computer Vision (pp. 1303-1311).
[Link to the document](#)

For more information, please contact David Rousseau (***david.rousseau@univ-angers.fr***)



Social media

Follow the project

