1. Content of the 'Topic Description' document

1.1. Topic area

A: Diagnostics, field detection, surveillance

1.2. Links to the Euphresco Strategic Research Agenda

The topic addresses the following objective(s) of the 2017-2022 Euphresco Strategic Research Agenda:
☒ Objective 2017-R-4.2: to explore the use of remote sensing technologies to support surveillance and detection activities
☒ Objective 2017-C-3.1: to favour knowledge exchange and support common initiatives with relevant players

1.3. Topic title

Remote sensing in plant health, expanding the scene.

1.4. Description of the problem the research should solve

In the previous Euphresco project 2016-I-226 'Remote sensing applications in plant health (PHeRS)', special attention was given to this technology with regard to the state of the art, the limits of research needs and gaps, the progress of research in identifying pests and pest host species. Concluding remarks highlighted the existence of numerous platforms (ranging from satellite to airborne and UAS technology) and sensors (optical RGB, multispectral/hyperspectral; thermal; microwave) designed for remote sensing data acquisition that can contribute in different ways to the monitoring of biotic and abiotic stresses of plants. Platforms and sensors have various spatial, spectral and temporal resolutions and provide valuable information for certain types of plants/crops and for certain plant health status. Most of these sensors can provide information about pest symptoms but not about the presence/absence of a particular pest.
The RS methodology, currently applicable to pest monitoring programmes, has technical and economic limitations:

- the low resolution of freely available satellite platforms (e.g. EU Copernicus programme) for the classification of large areas (vegetation classification mainly of host plants with homogeneous coverage) and for a higher temporal resolution;
- the high costs of high-resolution aerial images (spatial and spectral) and the restrictive regulation for the use of drones;
- the few sensors available in the market, which are expensive, high weight and no specific for pests or pest hosts (only a few band sensors);
- the few automatic procedures for plant identification and counting (e.g. plant mapping; precise sampling procedures) and pest recognition;
- lack of harmonised data quality;
- lack of expertise in data processing and interpretation and in plant health.

In this context, ongoing and future research on RS is focusing on the early and accurate detection of infection through the:

- identification of a "wavelength package" pest-specific;
- development/customization of specific sensors to target pests and host plant;
- enhancing sensor technology through readiness levels (TRLs 1 to 9);
- combination of satellite data with drone data to improve the accuracy of pest and pest and host identification.

Considering that in PHeRS it was highlighted to enlarge the partnership to other EU and no-EU institutions/organisations and establish an EU network of experts, the goal of the new project is to develop an accurate RS approach through transnational research to better target disease/infection surveillance and provide data for mitigation responses.
To this end, this project will broaden the scene of RS application in the phytosanitary field

with the scientific and technical input of a wider group of EU and no EU partners. Based on the results of the previous project, the experience of this wider group of partners and the results of ongoing research in partner institutions, an innovative approach to the application of RS in various areas of plant health will be explored, regardless the type of pest and pest host species.
The activity will be carried out at two levels:

- one applied level, benefiting from the current RS methodologies and approaches that can be shared among the partners; it will provide partner information on technologies, infrastructures and pest-crop applications;
- one research level, benefitting from results of ongoing initiatives on specific pests and crops at partner institutions/organisations.

1.5. Description of the expected results

The project will:
Map RS applications and research: the activity will consist in mapping the ongoing work (applications and research) in this area at partners' institutions to define a list of actions to be undertaken and shared during the project. To this end, a first workshop will be organized in order to bring together all partners and create working collaborations on common pests and/or crops.
Develop a standard method of RS application through transnational research: partners should conduct scheduled activities for the identification of target pest outbreak on specific host plant species. Results of applications and ongoing research in RS gained by partners will converge in a final meeting which will focus in the development of innovative, sustainable and friendly approaches of RS in plant health which can have a broad spectrum use.

1.6. Beneficiaries of this research product

The outputs will benefit National Plant Protection Organizations.

1.7. Research funders and research contribution/ distribution

Funding organisation	Research activity and researchers involved
1. Coordinator to be identified	-Project coordination; Contact person: E-mail address:
2. Australia Con Goletsos ACPPO@agriculture.gov.au	-Artificial Intelligence methods for early disease detection using hyperspectral and thermal imagery; Contact person: Pablo Zarco Tejada E-mail address: pablo.zarco@unimelb.edu.au
3. Austrian Agency for Health and Food Safety, Austria Sylvia Bluemel sylvia.bluemel@ages.at	-RS model (drones equipped with RGB and multispectral sensors) for the detection of regulated harmful organisms; Contact person: Helga Reisenzein E-mail address: helga.reisenzein@ages.at Contact person: Ulrike Persen E-mail address: ulrike.persen @ages.at
4. Flanders Research Institute for	-RS model (drones equipped with RGB and

Agriculture, Fisheries and food, Belgium Kris De Jonghe Kris.DeJonghe@ilvo.vlaanderen.be	multispectral sensors) for the detection of harmful organisms in potato; Contact person: Nicole Viaene E-mail address: nicole.viaene@ilvo.vlaanderen.be Contact person: David Nuyttens E-mail address: david.nuyttens@ilvo.vlaanderen.be
5. Denmark Mogens Nicolaisen mogens.nicolaisen@agrsci.dk	-Use of different drones equipped with RGB and multispectral cameras for detection of different diseases in cereals and potatoes; - Field robot equipped with RGB, LIDAR laser and thermal camera to detect diseases and abnormalities as a result of diseases/pests; - Images analysis including development of algorithms based on different machine learning methods; Contact person: Rene Gislum E-mail address: rg@agro.au.dk
6. Bundesministerium für Ernährung und Landwirtschaft, Germany Bettina Beerbaum bettina.beerbaum@bmel.bund.de Silke Steinmöller silke.steinmoeller@julius-kuehn.de	-RS techniques for detection of potato cyst nematodes and forestry pests; Contact person: Silke Steinmöller E-mail address: silke.steinmoeller@julius-kuehn.de
7. International Center for Advanced Mediterranean Agronomic Studies, Italy Anna Maria D'Onghia donghia@iamb.it	-Research on proximal sensing for correlating wavelengths to plant metabolites pest-specific; Contact person: Franco Santoro E-mail address: fsantoro@iamb.it
8. Council for Agronomic Research and Bioeconomy Analysis, Italy Luca Riccioni luca.riccioni@crea.gov.it	-high-tech thermal and multispectral cameras and spectrophotometers for early detection of plant diseases, before symptoms appearance; Contact person: Marcello Biocca E-mail address: marcello.biocca@crea.gov.it
9. Ministry of Agriculture, Forestry and Food, Slovenia Erika Oresek erika.oresek@gov.si	-RS for early detection of nematode infestations in potatoes at different spatial levels (from tuber to field using different sensors (multi- and hyperspectral, thermal, RGB); Contact person: Uros Zibrat E-mail address: uros.zibrat@kis.si Contact person: Matej Knapic

	E-mail address: matej.knapic@kis.si
10. Science and Advice for Scottish Agriculture, United Kingdom David Kenyon david.kenyon@sasa.gov.scot	-Proximal sensing (reflectance analysis to assess cereal crop stress; ground-truth data for aerial image analysis for several diseases) and have developed a novel spectral processing approaches to optimise the accuracy of in-field spectroscopy; Contact person: E-mail address:
11. Department of Environment, Food and Rural Affairs, United Kingdom Elspeth Steel Elspeth.Steel@defra.gov.uk	-Readiness levels of sensor technology through the TRL Levels; Contact person: E-mail address: Paul.Brown@fera.co.uk
12. Vito Remote Sensing, Belgium Stéphanie Delalieux stephanie.delalieux@vito.be	-RS model (drones equipped with RGB and multispectral sensors) for the detection of regulated harmful organisms; Contact person: Stéphanie Delalieux E-mail address: stephanie.delalieux@vito.be
13. National University of Ireland, Maynooth, Ireland Rowan Fealy Rowan.Fealy@mu.ie	-Contribution to be detailed; Contact person: Rowan Fealy E-mail: Rowan.Fealy@mu.ie
14. University College Dublin, Ireland Fiona Doohan fiona.doohan@ucd.ie	-Contribution to be detailed; Contact person: Fiona Doohan E-mail: fiona.doohan@ucd.ie Contact person: Sonia Negrao E-mail: sonia.negrao@ucd.ie Contact person: Julio Isidoro Sanchez E-mail: j.isidro@ucd.ie
15. Naktuinbouw, the Netherlands Marcel Toonen m.toonen@naktuinbouw.nl	-RS model (drones equipped with RGB and multispectral sensors) for the detection of regulated harmful organisms; Contact person: E-mail address:
16. 2Excel geo, United Kingdom Chloe Barnes chloe.barnes@2excel.uk	-Hyperspectral data collection (airborne and field based; Contact person: Chloe Barnes E-mail address: chloe.barnes@2excel.uk
17. James Hutton Institute, United Kingdom Damien Bienkowski Damian.Bienkowski@hutton.ac.uk	-Conduct field and controlled environment plant health trials (agriculture/ horticulture); -Collect and analyse spectroscopy data; -Collect and analyse ground-based hyperspectral imaging and UAV-based RGB/multispectral and potentially

	hyperspectral imaging; -Develop automatic methods for image analysis for disease detection; Contact person: Damien Bienkowski E-mail address: Damian.Bienkowski@hutton.ac.uk Contact person: Matt Aitkenhead E-mail address: Matt.Aitkenhead@hutton.ac.uk Contact person: Adrian Newton E-mail address: Adrian.Newton@hutton.ac.uk Contact person: Dominic Williams E-mail address: Dominic.Williams@huttonltd.com

1.8. Research project partnership outside Euphresco

Euphresco funding ensures a certain level of transnational collaboration among Euphresco member countries. It is possible, if the funding consortium is interested, to contact funding organisations or research groups outside the geographical area covered by Euphresco members. The Euphresco coordinator could advertise the research topic in order to have an enlarged collaboration. If funders are interested in this possibility, please check the case below:

☐ The funding consortium of the topic mentioned in section 1.2 requires that the topic is advertised outside the Euphresco network

An expression of interest to collaborate on the topic was received from the company CYBELETECH. Their participation will be confirmed on the basis of the activities of the project.

1.9. Any other relevant information on content

None.

2. *Euphresco management aspects of the project*

2.1. Indication of the topic budget

Funding organisation [a]	Mechanism [b]	Total Budget [c]
1.	NC	€
2. (AU)	NC	€
3. AGES (AT)	NC	€
4. ILVO (BE)	NC	€
5. AGRSCI (DK)	NC	€
6. BMEL (DE)	NC	€
7. IAM (IT)	NC	€
8. CREA (IT)	NC	€
9. MKGP (SI)	NC	€
10. SASA (GB)	NC	€
11. Defra (GB)	NC	€
12. Vito (BE)	NC	€
13. MU (IE)	NC	€
14. UCD (IE)	NC	€
15. Naktuinbouw (NL)	NC	€
16. 2Excel geo (GB)	NC	€
17. JHI (GB)	NC	€
total		€

2.2. Expected duration of the project (only for non-competitive topics)

24 months.

2.3. Identification of project coordinator

Has the research project coordinator been identified?

☐ Yes
☒ No

2.4. Any other relevant information on topic organisation and management

If a project coordinator is not identified by 2019-11, the project will not be initiated.

[a] First member is project coordinator. A minimum of two partners are necessary for each proposal. Add lines as needed.
[b] Please indicate the preferred mechanism (e.g. real pot RP; virtual pot VP; non-competitive NC), or several mechanisms if there is flexibility.
[c] Optional, as this amount can still change in the next phase. In-kind contribution should also be indicated in this column.