PINA



Decision Support System

. SELECT

the PPP applications

New bio-PPPs

Plant pathology analysis

and commercial Bio-PPPs Screening of synthetic PPPs

Monitoring of occurrence Community testimonies of

Dosage, formulation and timing o

Evaluation of under-developmen

Genetic, evolutionary and agronomic drivers of host and PPP resistance

OPTimised Integrated Pest Management for precise detection and control of plant diseases in perennial crops and open-field vegetables

The Problem

Global agriculture relies on synthetic Plant Protection Products (PPP) for plant disease control to support sustainable yield productivity. Farmers and crop advisors follow conventional crop protection strategies that were established after the Green Revolution (1950-1960), maintaining significant use of PPPs despite the negative impacts on the environment and human health. This clearly indicates that more sustainable PPPs should be used under common rules for safer and more efficient application.

The Approach

The proposed IPM system consists of innovations in DSS for disease prediction, early disease detection and **OPTIMA** alternative synthetic PPPs methods, substituting/supportive bio-PPPs, optimized dosage and timing of treatment schemes, and smart



Routes of environmental contamination from PPPs

spraying applications of PPPs to improve deposition and coverage, while reducing the risk of contamination.



DSS accuracy level

DETECT for identifying and localizing the disease infection severity, developing an advanced portable disease detection system mounted on a tractor based on spectral images analyzed using pattern recognition and deep learning techniques to achieve high-speed and accurate infection detection.



extended LCA Prediction DSS and portable Multi-criteria decision analys

5. ASSESS

ozzle and air support sett Canopy characterization Drift reduction technologie Variable rate application proposed IPM strategy echnologies cted bio- and synthetic PPP Section contro Droplet size control

2. DETECT

systems

cameras

Advanced disease detection

Hyperspectral/multispectra

Pattern recognition

Artificial intelligence

Deep learning techniques

PREDICT plant diseases outbreak using a DSS that receives information from disease prediction models, micro-climate data, data detection system and end-users by a testimonies through an App.



Imaging disease detection system (left) of a heavily diseased cyclamen plant. Plant part segmentation on a sweet-pepper crop (right).

SELECT for determining the appropriate PPP formulation (synthetic and biological) with increased specificity and improved environmental performance (e.g. with reduced effects on non-target organisms and natural resources), the dosage and the timing of the application for

each disease, after continuous field experiments with PPPs, as well as

OPTIMA Overall Objective

The overall objective of OPTIMA is to develop an environmentally friendly Integrated Pest Management (IPM) framework for use-cases in Apple orchards, vineyards and open-field carrots by providing a holistic approach which includes the major elements related to integrated disease management:

combined use of bio-PPPs and synthetic PPPs,

(ii) DSS for disease prediction,

(iii) spectral disease detection systems,

(iv) precision spraying techniques.

Grape downy mildew (A), Alternaria leaf blight (B) and apple scab (C, D)

APPLY for developing three new smart sprayers for by optimizing the spray precise PPP field use configuration, characterizing droplet size, adjusting nozzle types and air-support systems, implementing developed software and hardware solutions for drift control, variable rate application, section and droplet size control.

PPP resistance testing.



Smart sprayer concept ideas

ASSESS for evaluating the IPM system regarding its direct and indirect impacts and risks from a

life-cycle perspective considering human health, environmental and economic impacts and risks.



OPTIMA Main work-flow diagram



Contact:

Dr. Thanos Balafoutis

Researcher

a.balafoutis@certh.gr

+30 2311 257651 | +30 2311 257650



Institute for Bio-economy & Agri-technology CERTH iBO | 6th km CharilaouThermi Rd. 57001 | Thermi | Thessaloniki | Greece www.ibo.certh.gr | www.certh.gr