PANtHEOn (precision farming in hazelnut orchards) for the improvement of Integrated Pest Management (IPM) effectiveness

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Abstract

The aim of this project is to develop the agricultural equivalent of an industrial Supervisory Control And Data Acquisition (SCADA) system to be used for the precision farming of large orchards of hazelnut (*Corylus avellana* L.). Unmanned aerial platform (UAV) and ground vehicles able to navigate in the orchard will be equipped to perform autonomously required operations as the collection of data on the plant growth habits, yield and on its phytosanitary status. Particularly, for the crop protection action it will be developed a system useful for the quantification of pest and disease incidence in the orchard, and for optimization of the quantities and the typology of pesticides used for insect pests and disease control. This will result in an increased effectiveness of Integrated Pest Managements (IPM)

Introduction and aims of the project

The improvement of the current hazelnuts (*Corylus avellana* L.) farming procedures comes from the necessity to answer to the needs of each single plant, especially in large plantations. This is especially important for aspects such as pruning and suckers' management, pest and disease control and for the estimation of nuts production.

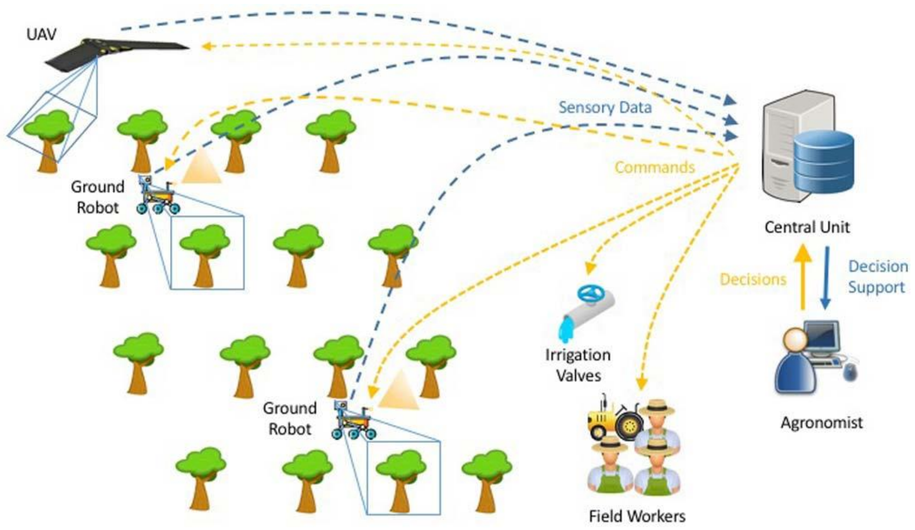

Fig. 1 - SCADA system for agriculture

Clearly, this has a relevant impact on the environmental and economic sustainability of the orchard.

With this premises, PANtHEOn aims to develop the agricultural equivalent of an industrial Supervisory Control And Data Acquisition (SCADA) system (Fig. 1) to be used for the precision farming of hazelnut large orchards, at the resolution of the single plant.

Methodology

Fig. 2 – Hazelnut orchard

This system involves the develop and the use of unmanned aerial platform (UAV) and ground vehicles able to navigate in the orchard and to perform autonomously required operations. These instruments using multispectral visible and near infrared (VNIR) and thermal data, collect records on the plant growth habits, yield and on its phytosanitary status. In particular, the gathered information will be useful for insect and disease detection, for their quantification of incidence and for the optimization of the quantities and the typology of pesticides used for insect pests and phytopathogens control at the granularity level of the single plant. This will improve the effectiveness of the IPM techniques for a more sustainable management of the ecosystem.

Pest and disease control

The biotic stress factors considered in this project are arthropods and phytopathogens fungi and bacteria:

- *Phytoptus avellanae,* a gall-mite that infests the buds (Fig. 3);
- True bugs, such as *Gonocerus acuteangulatus, Palomena prasina*, *Nezara viridula* and the recently introduced *Halyomorpha halys* (Fig. 4), involved in the kernel abortion, malformation, and the "cimiciato" flavour;
- Cytospora canker, involved in apical and complete desiccation of the branch
- *Fusarium lateritium*, agent of nut gray necrosis (NGN);
- *Pseudomonas avellanae* and *Xanthomonas arboricola* pv. *corylina* ([1], [2]).

Fig. 3 - *Phytoptus avellanae*

Fig. 4 - *Halyomorpha halys*

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References:

[1] Scortichini, M. 2006. Le principali avversità del nocciolo nel Lazio. Petria 16:31-44.
[2] Lamichhane JR, Bartoli C, Varvaro L (2016). Extensive Field Survey, Laboratory and Greenhouse Studies Reveal Complex Nature of Pseudomonas syringae-Associated Hazelnut Decline in Central Italy. PLOS ONE, vol. 11, p. 1-15