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DROLIVe: a platform for monitoring olive groves

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Introduction

In the Mediterranean basin, olive groves represent one of the most important and valuable cultivation increasing local farming incomes and providing several ecosystems services. The largest olive oil production derives from Spain which produces about 1400k tons (t) followed by Italy 474.6k t and Greece 320k t in 2015–16 (IOOC, 2018). In Italy, Tuscany is the 6th ranked region for olive oil production but the land use changes restricted olive groves to marginal areas. In this context, precision agriculture and crop modelling may represent useful techniques and tools for monitoring the health status of olive groves, providing a support to farmers in applying management practices to make the cultivation more profitable. Building on these premises, the DROLIVe project (POR FSE 2014-2020) is focused to develop a monitoring platform of olive groves for a specific area of Tuscany by coupling remote sensing techniques with phenological modelling.

Materials and Methods

Two-olive grove status was monitored during 2018-2019 field campaigns conducted in Montalbano area (Tuscany). The use of different Vegetation Indexes (Vis, NDVI, GEMI, OSAVI), derived by Drone and Satellite imageries (Sentinel 2 and Landsat) and field measurements (ceptometer, SPAD), allowed to describe the overall trend of vegetation along the olive growing season and some important vegetative parameters (e.g. Leaf Area Index (LAI), Photosynthetically Active Radiation (PAR) and yield). Moreover, two weather stations were installed for recording (every 15 minutes) the main weather and soil variables (air temperature and humidity and soil moisture). Finally, two phenological models were implemented and calibrated for reproducing bud-break, flowering and 50% of veraison stages. The first phenological model is based on the GDH (growing degree hour) computation and it is used for estimating the vegetative bud opening, according to a specific temperature threshold. The second model (UNICHILL; Chuine, 2000) is based on the chilling-forcing approach and it is used for estimating flowering and veraison stages.

Results and Discussion

The results evidenced a strong decrease of the VIs average value during summer period in correspondence of grass cutting and drought conditions, which reduce the grass spectral reflectance. We also found a satisfactory correlation between LAI and PAR and the VIs value during the olive growing season (LAI: Average Pearson $\bar{r}$ = 0.71; PAR: $\bar{r}$ = 0.67). The phenology of olive tree was reproduced by calibrating two phenological models for budbreak and flowering of a standard olive tree variety (flowering: RMSE= 3.00, r= 0.82; Moriondo et al. 2019). Finally, we analyzed the relationship between NDVI and olive production (kg of olives) during six years. In this context, we found that the best correlation between these two variables is expected in July, according to the maximum decrease of grass cover in the inter-row.

Conclusions

The DROLIVe project shows how the use of new technology coupled with crop modelling may allow giving important information about olive groves growth and development also in marginal areas. The implementation of this software platform may represent the starting point for providing a useful support tool in agriculture.

Acknowledgements

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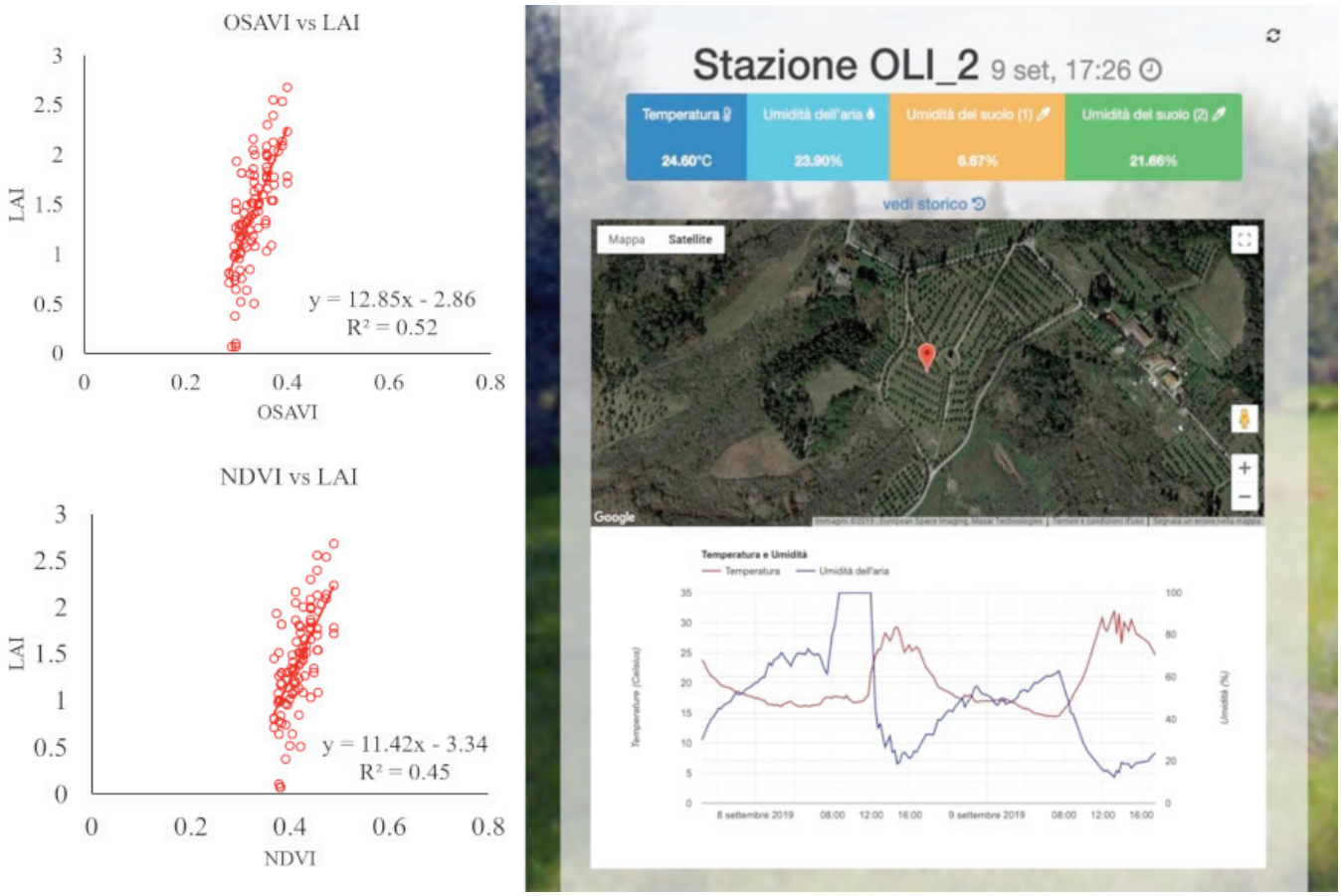

Figure 1. DROLIVe platform (right) and VIs correlations (left).

Keywords: Crop monitoring, Olive groves, Precision Agriculture.

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