CONSERVATIVE PRECISION AGRICULTURE: FIRST ECONOMIC AND ENERGETIC ASSESSMENTS WITHIN THE AGRICARE PROJECT

Donato Cillis, Andrea Pezzuolo, Francesco Marinello, Luigi Sartori

Department of Land, Environment, Agriculture, and Forestry – University of Padova, Italy

E-mail: donato.cillis@studenti.unipd.it

Key words: Precision Agriculture, Conservation Agriculture, Economic balance, Energetic analysis.

The integration of conservation tillage techniques with the principles of site-specific management characterising precision agriculture is an innovative feature aimed to achieve better economic and environmental sustainability, increasingly required by Community agricultural policies.

In fact, the most efficiency use of inputs, one of the benefits related to precision agriculture technology, could mitigate the problem linked to the conservation tillage techniques on some crops in terms of yield, which would put in secondary place the countless agronomic and environmental advantages deriving from them. Therefore, quantify the economic and energetic potential benefits obtainable from possible synergies allows to collect useful information for adapting conservation tillage techniques to the spatial and temporal variability characterising the fields. The experimentation, got to its second year of activity, is performing under the LIFE + AGRICARE project (LIFE13 ENV IT AGRICARE 0583) at the pilot and demonstrative farm Vallevecchia of Veneto Agriculture, compares three conservation soil tillage techniques (minimum tillage, strip tillage and no tillage) with conventional tillage techniques, examining four different crops in a specific rotation (wheat, canola, corn, soybean).

According to the different homogeneous zones derived from the study of the variability, the different conservation tillage techniques managed with variable rate treatments are compared with a central plot characterized by fixed-rate application of inputs that acts as a test. From the study of the variability can be observed that the study area is composed by 4 homogeneous zones with different production potential. On the basis of their features, the optimal rates of nitrogen fertilizer and seed applicable to each crops and soil tillage technique have been identified by consulting the elaboration derived from the predictive model SALUS. Thanks to the portion of the field managed in a fixed rate used as a test, it is possible to observe the contribution made by precision farming and the possible synergies established with the different conservation tillage techniques.

The yield data relating to the yield maps coming from the first year of the experimentation were compared and calibrated in order to have the realistic production data of each homogeneous zone; with these data, it has been performed an economic and energetic analysis that has allowed to quantify the gross income and the net energy for different homogeneous zones characterising the study area.

The preliminary results show that all the conservation soil tillage techniques achieve a positive synergy by adopting the principles and the technologies of precision agriculture. The automatic guidance system and the devices adopted, capable of performing the variable rate application of inputs such as seed and fertilizer, have allowed to increase the efficiency of use of inputs enjoying better economic and energetic results than the test managed with a fixed rate application of input.

Finally, starting from the yield maps have been made economic and energetic maps showing the points of the field characterised by drop or gain in terms of gross income, and high or low net energy profits for each thesis.

DEVELOPMENT AND PRELIMINARY TEST OF A MOBILE LAB FOR THE ORCHARD CROP MONITORING

Daniela D'Auria, Gianluca Ristorto, Fabrizio Mazzetto

Libera Università di Bolzano, Facoltà di Scienze e Tecnologie, Italia

E-mail: daniela.dauria@unibz.it

Key words: NDVI, Lidar Sensors, Optical Sensors, Precision Agriculture.

The automated crop monitoring is currently still a challenge aimed at both consolidating the ICT in the agricultural industry and implementing a new concept of information system for the agri-environmental company. Moreover, this kind of monitoring is an essential point for the precision agricultural application, especially for the intervention of farming therapy (such as fertilization, treatment, thinning) where the knowledge of the farming physiological state becomes essential for the automatic control of the process.

Thus, crop monitoring is becoming more and more relevant for both the information management applications and for the automation of the field methods. These applications significantly affect the type of carrier (airplane, drone, tractor, even if a fixed station) to be equipped with sensors (optical, ultrasound etc.) suited for real measurements.

In fact, the classical approaches of remote sensing return top-view-based recoinnaissance and generate thematic maps, from which then obtaining illustrated maps used for the automation of the delayed processes. Differently, the ground sensing survey (or proximal sensing), typically used in orchard, exploits some sensors - mounted on a mobile ground carrier – returning some three-dimensional maps according to the side-view logic.This latter approach, is currently the most used for real-time automation intervention and is preparatory for robotic applications.

Furthermore, in the context of a project for crop monitoring (Monalisa Project), a mobile Lab has been developed in order to implement crop monitoring in orchard based on a combined use of Lidar (stereoscopic configuration) and optical sensors (NDVI).

An inference algorithm combine the data related both to the canopy volume and to the physiological state (acquired from the NDVI index), thus identifying different types of stress situations.

In this study, we present the preliminary diagnosis algorithm used to determine the phytosanitary status of the plants; then some results obtained from the measurements in a controlled environment are shown.

Future work will be devoted to the design, the development and the use of a specific index in order to improve the efficiency of the overall process and to be applied for the next experiments.