iFAROS – A Multi-source Digital Farming System for Site-specific Nitrogen Application in Winter Wheat - Abstract

Tetiana Pavlenko[1], Galibjon M. Sharipov[2], Manuel Pérez-Ruiz[3], Jorge Martínez-Guanter[3], Jacob Carballido[4], Andreas Abecker[5], Thomas Anken[6], Francesco Argento[7], Susanne Braun[1], Dimitrios Argyropoulos[8], Dimitrios S. Paraforos[2]

[1]University of Hohenheim, Research Center for Bioeconomy, Stuttgart, Germany; e-mail: tetiana_pavlenko@uni-hohenheim.de
[2]University of Hohenheim, Institute of Agricultural Engineering, Stuttgart, Germany
[3]Agroplanning Agricultura Inteligente S.L., Sevilla, Spain
[4]Perdum, Lokeren, Belgium
[5]Disy Informationssysteme GmbH, Karlsruhe, Germany
[6]Agroscope, Tänikon, Switzerland
[7]ETH Zürich, Zurich, Switzerland
[8]University College Dublin, Dublin, Ireland

Summary

The challenge to meet 2050 food demands while minimizing or reserving environmental harm from agriculture will be critical if we are to ensure that agriculture is sustainable in terms of healthy soil, clean water, greenhouse gas balance or economy viability. A key aspect is to increase production through optimized use of the available natural resources with a minimal environmental impact. Recent work has shown that fertilizers can be used with much greater efficiency than is currently the case in many of Europe's cropping systems. The iFAROS project, funded by ICT-AGRI, is developing a multi-source digital farming system for site-specific nitrogen application in winter wheat (*Triticum aestivum L.*), which is the most important crop in Europe and is produced in 56 million hectares.

The overarching aim of the iFAROS project is to sustain and increase agronomic productivity and environmental performance for small European farmers. The technical objectives of the iFAROS project are: (1) To develop a new cloud-based application, acting as an intelligent middleware with data analytics capabilities, for the collection, storage and integrated processing of the data coming from and related to agricultural production, deriving from data sources such as farm machinery, UAVs, Wireless Sensor Networks (WSN), and other sources of open data at the farm and at a regional level; (2) To realize better decision-support algorithms for farm management and operations. In particular, this will include the creation of application maps for VRA of fertilizers, yield prediction, and the reporting for whole-farm management productivity costs; and (3) To apply the produced site-specific management fertilizer application map in an automated manner by utilizing ISO 11783 (ISOBUS). To achieve this, specific hardware had to be designed and validated.

Proceedings of the 9th International Conference on Information and Communication Technologies in Agriculture, Food & Environment (HAICTA 2020), Thessaloniki, Greece, September 24-27, 2020.

The system allows the connection of a commercial nitrate soil & NDVI crop sensor and its bridge into the tractor communication infrastructure. To reach bi-directionality, not only information from the device is sent to the cloud platform but also file transfer between the cloud services and the tractor is supported. In this regard, the integration of information systems from satellite/UAV data as well as from proximal remote sensors, and the automated generation of management zones are carried out in such a way that it can be adapted to a suitable form for end-user devices. A unifying layer (middleware) was developed to interconnect the components in the tractor with the information from the remote sensing database, creating a set of common network communication protocols principles (Open API) between the vehicle devices and cloud platform.

The results of the first year highlight the technical characteristics and the information flow of the developed middleware as well as the developed hardware, which enables the automated collection of ISOBUS data. Furthermore, the hardware acts as a gateway between the FMIS and the tractor terminal by downloading the developed site-specific nitrogen application to the Task Controller of ISOBUS.

Keywords: Precision farming; sustainability; site-specific fertilization.