IMPLEMENTATION OF ARTIFICIAL INTELLIGENCE SYSTEMS IN THE AGRICULTURAL FIELD: AGRODATA PROJECT

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Abstract: *The agricultural field has become an increasingly dynamic field. Precision agriculture and new technologies implemented in this field are new well-defined concepts based on those currently existing on farms. In order to maximize agricultural production, farmers have become aware of the need to implement these new technologies. Once implemented, their role is to reduce farm costs, increase crop productivity but especially to produce more efficient management and timely management of the farm by providing a real-time dashboard. The AGRODATA project aims to create digital orthophotoplanes in order to highlight certain parameters of agricultural crops, such as the degree of attack of diseases and pests, the degree of water reserve in the soil, the amount of chlorophyll, soil moisture and its pH. The project was founded by the Research-Development Station for Agriculture Brăila, together with the company Livadi SRL, Brăila. At the same time, Agrodata has the role of implementing the digital environment in farms and creating a "dashboard" of farms, an overview through which farmers can see in due time, each crop (on all its phenophases). Through the AGRODATA project, crop surveillance systems were implemented through the use of state-of-the-art drones, equipped with artificial intelligence, the implementation of sensors that monitor the factors that act on crops (temperature, humidity, pH, etc.). The results of the project were very good, following the drone flight over the agricultural crops of Livandi SRL, the following parameters were identified: the amount of mobile phosphorus, the amount of salts, the amount of potassium in the soil and mobile nitrogen, the parameters that will be described in what's next.*

Key words*: agriculture transition, agriculture of the future, artificial intelligence, agriculture 5.0, digitalization of agriculture*

INTRODUCTION

Due to recent climate change, farmers have had to look for and use a range of new technologies so that they can protect their crops from extreme events but also know in due course the parameters of each crop. In order to achieve these goals, farmers have begun to migrate from traditional agriculture to digital agriculture, this transition being made with the implementation of the Internet of Things (IoT), the transition from traditional mapping to digital mapping, the implementation of new technologies. mapping of agricultural lands, all these aspects being transposed in the digital environment. The implementation of these technologies in the agricultural field had the role of supporting farmers in the processes of agricultural productivity. The purpose of these technologies was to increase the productivity of agricultural crops and to protect and maintain in optimal parameters soil resources, without polluting the environment. [5]

The AGRODATA project aims to implement state-of-the-art technologies based on artificial intelligence (AI), high-performance software in order to ensure much faster data processing, in a timely manner so as to present a dashboard to farmers. in real time on their cultures [11]. Sustainable agriculture is a concept in which the potential of drones can be used to the maximum, these technologies being the basis in the near future of agri-food production systems, drones being the key sources of the ultimate objectives of agriculture

[3]. The drones had a positive impact on agriculture. Their use in the preparation of agricultural land, in the processes of sowing crops as well as in the monitoring of phenophases, allowed the creation of 3D maps, which will present an analysis of the content of the elements and the germination stage of the seed material. At the same time, drones facilitate the work of farmers in their processes of sowing agricultural crops, so as to reduce soil compaction and soil compaction as little as possible [9]. The creation of digital maps in 3D format will allow farmers to constantly know the status of both the seeded seed and the condition of the plants in each phenophase. If the drone detects a small amount of minerals needed for crop growth, development and productivity, the drone fertilization system will allow the placement of nutrients directly to the ground, directly on the problem surface and where the soil has a deficiency of elements [6].

This article aims to present one of the sustainable, sustainable strategies that the Brăila Agricultural Research-Development Station has adopted in the process of combating the phenomena that produce climate change. For a start, the main reference points in the implementation of new technologies within SCDA Brăila are mentioned, technologies that have the role of maintaining a sustainability of Romanian agriculture, in the Bărăgan Plain. Another important aspect is the explanation of how to use these new technologies with which farmers can achieve the sustainability of crops, going through several stages, processes and strategies that farmers can prepare and use to increase their sustainability and maximization. of agricultural productivity. The present research that is the subject of this article presents important conclusions on how to grow and develop farms as well as a strong emphasis on maximizing agricultural productivity. The implementation of such technologies in the agricultural field will bring with it a maximization of agricultural production, obtaining an additional profit but especially a reduction of costs related to the daily activity of the farm.[4]

New digital technologies based on precision drones (identification of diseases and pests, fertilizer spraying, insecticides, etc.) and their connection to the Internet, have led to an increasing increase in agricultural productivity and, consequently, to an increase in demand. of agricultural products. After analyzing the data and transposing them in the form of information, each farmer will know exactly what is the situation of each crop, what are the requirements of that crop and what the farmer must intervene in the crop so that productivity is maximum without affecting or polluting. the agricultural ecosystem [2]. AGRODATA has the role of projects that combine artificial intelligence technologies will lead to a much better and productive management of crop yields, irrigation, agrochemical mapping, development of soil deficiency treatment plans, monitoring of crops in any phenophase, determination of weeding, degree of attack of pests, diseases, their typology [16] and monitoring the condition of the soil regarding the amount of elements that the soil has or lacks [1]. AGRODATA is an excellent project, representative for farmers who want to get involved in the processes of stopping climate change, in the processes of restoration and reintroduction into the agricultural circuit of soils with high acidity [15] but also for farmers who want to move from conventional agriculture to sustainable, sustainable and ecological agriculture with the environment.[7

MATERIALS AND METHODS

The main objective of the AGRODATA project is the implementation and research of new technologies and systems that use digital technologies equipped with artificial intelligence, in order to relaunch new processes to maximize agricultural production. experimental fields of the Research-Development Station for Agriculture Brăila. The research was carried out with the equipment from SCDA Brăila.

The following were used as working materials: two drones equipped with artificial intelligence systems (in order to identify the degree of attack of diseases and pests, the amount of mineral elements in the soil, the amount of chlorophyll in plants, etc.), humidity and pH sensors , weather station and devices for detecting temperature fluctuations, precipitation and wind. As methods, in order to carry out this research the following were used: empirical research methods (research based on the surrounding realization, in this case the experimental fields of SCDA Braila), cross-sectional research methods), observational methods (observations made on cultures in experimental fields), qualitative methods (description and analysis of the activity of the process itself, emphasizing more the process and the importance of research).

RESEARCH RESULTS

The impact of the AGRODATA project on Romanian agriculture and research was very large, the researchers from SCDA Brăila being the first to use a series of state-of-the-art technologies. Why is this project important for Romanian agriculture? With the help of the technologies used, each farmer who joins this project can monitor each crop in real time so that, for each crop, a dashboard is created that has the role of providing the farmer with all the information in order to make a decision in time. real. Through this project, a series of analyzes were carried out on the soil and agricultural crops, analyzes on the agrochemical mapping of the soil (content of moving elements in the soil), scanning the soil with a precision drone, and the degree of disease attack and pests in crops overflown by drones.

In order to highlight the importance and effect of these new technologies, researchers at SCDA Brăila used a state-of-the-art drone equipped with remote sensing systems, artificial intelligence and disease and pest recognition systems. At the same time, with the help of the second drone, a series of orthophotoplanets were made that have the role of highlighting the soil characteristics, identifying its pH, the amount of moving elements in the soil and the water reserve in the soil. At the same time, in order to support these steps in the process of identifying the mobile elements in the ground, a scanner type device was used within the resort, namely Soil Xplorer. With the help of this scanner, a soil scan was performed in order to highlight the amount of mineral elements in the soil, the degree of development of beneficial fauna and some of the pests existing in the soil (figure 1).

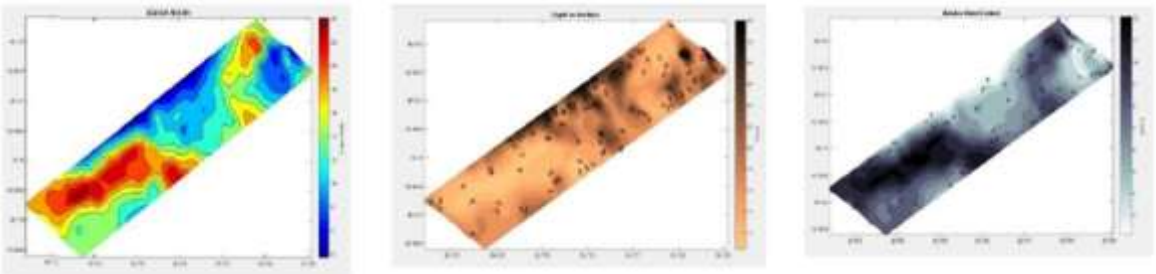

Figure 1. Soil Xplorer scanning
(a- soil structure; b- soil compaction; c- soil moisture)
Source: SCDA Brăila, 2019

After scanning the soil with both the scanner and the drone, a series of soil parameters were identified, as follows: the color red is a lack of the amount of the main elements in the soil (nitrogen, phosphorus, potassium), this aspect means that that the crop has a nutritional imbalance. The orange color shows an amount that exists in the soil but

not entirely enough for plant nutrition. With the increase of the color spectrum, we can see that depending on the phenophase of the plants in that culture, we can see their nutrition and soil saturation with the elements necessary for plant growth and development, the blue color representing the fact that the soil contains sufficient quantities of mineral elements necessary for plant growth and development.

In order to make a series of determinations, a series of UAV drone flights were performed on the maize crop within the experimental fields of SCDA Brăila, a drone that had the role of making orthophotoplanets so as to make a base of online data, based on the results obtained by the drone. The role of the drone is to organize research groups within SCDA Brăila (depending on the specificity of each crop), sunrise and plant density, observation of plant anomalies, estimating and monitoring the content of mineral elements in the soil, estimating the degree of attack of pests, their monitoring and diseases in agricultural crops and the estimation of crop productivity, based on the above.

Figure 2. Realization of flights with drone UAV corn culture CE Chişcani

Source: SCDA Brăila, 2019

Following the soil and plant scanning processes, after downloading and processing the data, the researchers from SCDA Brăila came up with a picture on the corn crop. Following these scans, in the maize crop, at certain plots (P1, P2 and P6- the red spots identified with the red color in the orthophotoplan) a low nitrogen content (in the soil structure) was identified, a "ragged" aspect of corn, the appearance of the burning phenomenon on the leaves of corn plants (Setosphaerie turcica) and the appearance of embers (Shacelotheca reiliana) (Figure 3).

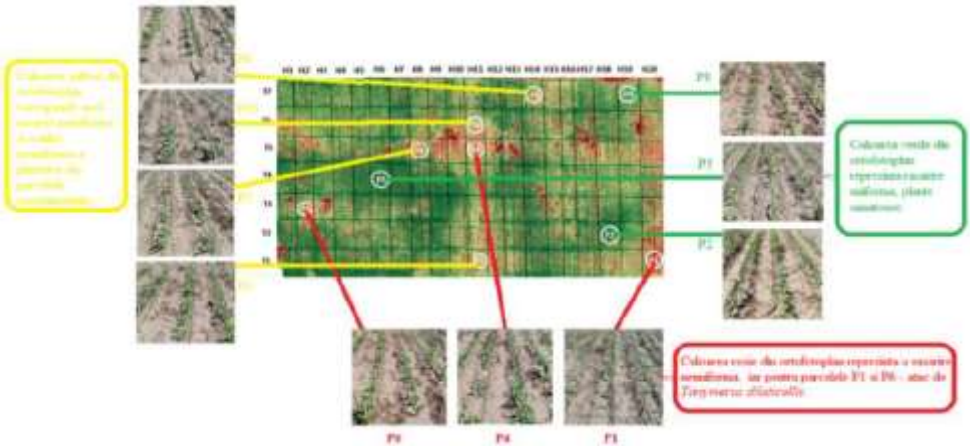

Figure 3. Orthophotoplan made by UV drone interpreting corn culture data

Source: SCDA Brăila, 2019

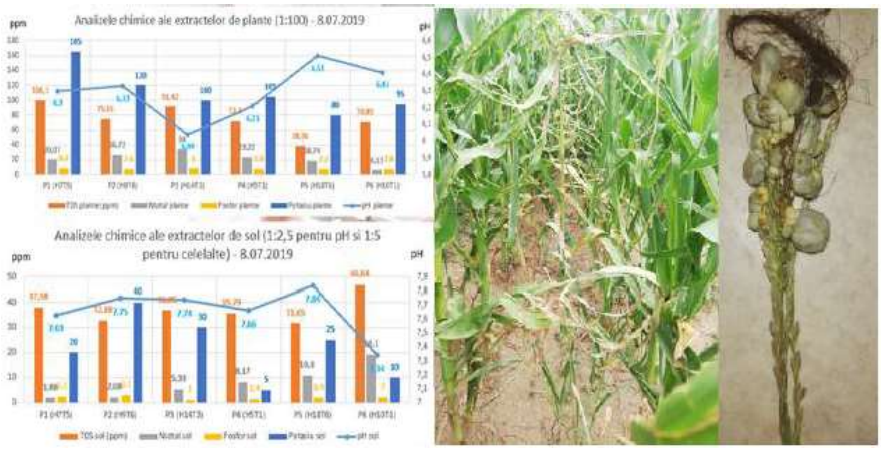

Figure 4. Agrochemical results and field observations (orthophotoplan corn crop SCDA Brăila)

Source: SCDA Brăila, 2019

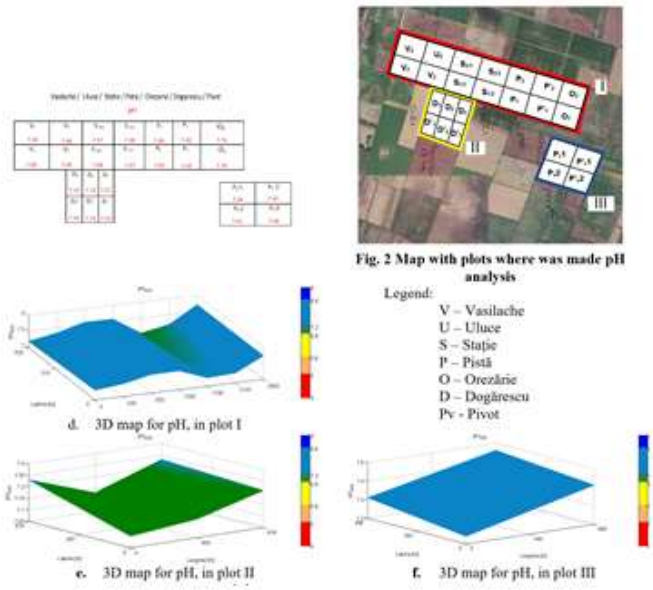

Figure 5. pH results from corn field (orthophotoplan corn crop SCDA Brăila)

Source: SCDA Brăila, 2019

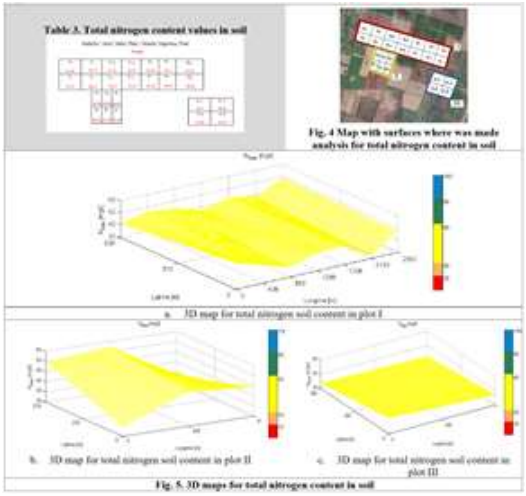

Figure. 6. The standard photocolorimetric method from the aqueous extract soil

Source: SCDA Brăila, 2019

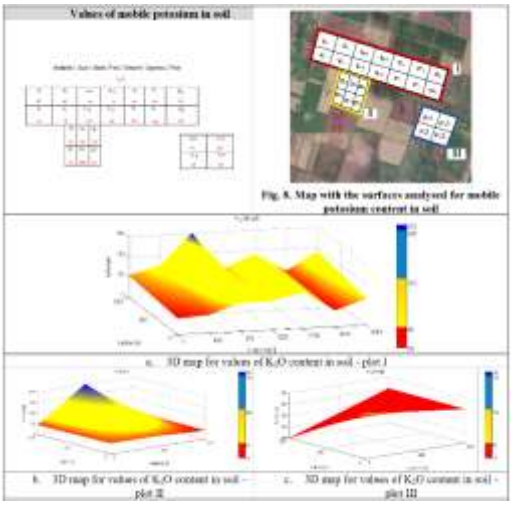

Figure. 7. The state of supply of mobile potassium

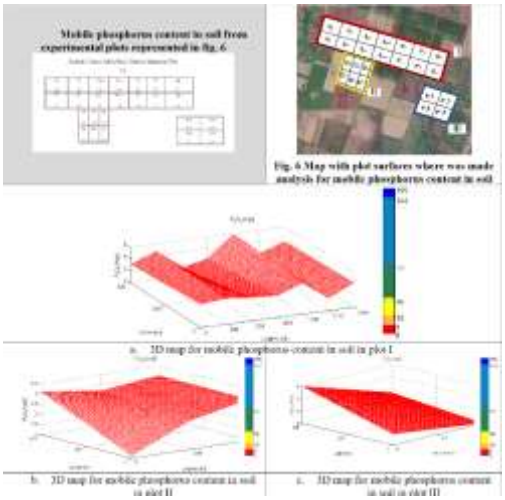

Figure. 8. The maps of the phosphorus content

After making orthophotoplans and repeated scans of agricultural crops within SCDA Brăila, a series of assessments of soil, crops and, implicitly, agricultural productivity were performed. Following the collection, analysis and interpretation of the data, the compaction state and the soil moisture were evaluated in order to achieve a differential soil processing, for each crop. Within the project, the state of soil fertilization, the state of pedo-climatic factors (soil moisture, pH, degree of compaction, texture, etc.) were determined. By interpreting the data and validating the results provided by the scans performed by the drone (orthophotoplans). Based on these data, the AGRODATA project provided in real time what are the parameters of corn cultivation, like into the next figures. Based on them, the researchers from SCDA Brăila created a calculation procedure for fertilizer doses (applied to each crop separately - in non-uniform areas of agricultural land).

After collecting the data, an online database was created (in the Blue Monitor system), a system that has the role of storing the pedo-climatic data provided by the weather station and ground sensors, the data obtained on each flight with UAV drones (disease detection and pests) as well as the elaboration of reports on the typology of pests, the typology of diseases and the elaboration of recommendations for their non-invasive control.

The AGRODATA online platform can also provide reports on the evolution over time of the registered pedo-climatic indices, warnings for the attack of diseases and pests, weather forecasts with recommendations for the application of phytosanitary treatments, the exchange of prices for agricultural products.

Drones technology is being used more and more often in the application and spraying of nutrients and pesticides on plant crops. The fact that these technologies are used at lower costs will allow farmers to reduce costs with human resources (workers) and technical resources (agricultural equipment). Spraying fertilizers and plant protection products in agricultural crops by air with the help of drones is a much cheaper option for farmers. These processes are much cheaper and much more environmentally friendly for humans, animals and the environment [14]. The use of these technologies represents many strengths for farmers because drones present to farmers in a timely state a frequent control of plants, their growth rate, early detection of health problems in crops (diseases, pests, etc.), limiting the effect pollutants of chemical fertilizers in agricultural crops, planning of sowing campaigns, fertilization and harvesting, distribution of fertilizers and plant protection products, etc. [12]

Following the analysis of the data obtained by the technologies used in this project, the results obtained were disseminated both online and among farmers in the North Bărăgan area, in order to join the AGRODATA plant. At the same time, the role of this project is to expand not only in Brăila County, but also in the counties bordering Brăila. Following the data analysis, this project calculated an economic efficiency of the lots scanned by the AGRODATA project compared to the lots where farmers did not use scanning technologies, as well as the influence of these technologies on reducing pollution in farmers' agroecosystems. The implementation of this project in agricultural farms has the role of improving the quality of life by:

a) Reduction of fuel consumption (verification of agricultural crops). The use of the satellite station, the use of the UAV drone, the observation, prevention and timely treatment of problems in agricultural crops will lead to a reduction in costs for farmers and a reduction in environmental pollution, soil compaction and, consequently, disturbance of the agroecosystem of those crops.

b) All data and results obtained in this project will be available online on the AGRODATA platform, a platform that will present a simple, friendly interface with immediate access to the needs and requirements of farmers and their registration in the system,

c) Based on the orthophoto plans made by the NDVI chamber, the project will contribute to reducing the amount of fertilizers used in agricultural crops, reducing the impact of pollution, applying treatments on certain parts of agricultural crops, applying customized treatments for each crop,

d) Increasing and maximizing agricultural production by eliminating classical technologies and excess chemicals.

CONCLUSIONS

The implementation of digitization technologies in the agricultural field and the transposition of agricultural crops in the online, virtual environment, the robotization of agricultural activities is a future perspective for farmers. The continuous development of these new technologies and their successful implementation in traditional agriculture will lead to an increase in agricultural productivity, an increase in the performance of the technologies used and a much better quality of agricultural products.

The fact that these new technologies have the role of facilitating the work of farmers will also increase the protection of the environment by preserving and regenerating the resources of agricultural agroecosystems. As such, the implementation of the AGRODATA project within the agriculture of North Bărăgan will lead to the development of an online platform, a much faster dissemination of the results obtained in agricultural crops, as well as a database that will provide farmers with information on pedo-climatic conditions. of their own agricultural crops, the health of the plants, the degree of attack of diseases and pests, as well as a series of recommendations of the specialists from the Research-Development Station for Agriculture Brăila.

The applications of the AGRODATA project aim at the transition of agriculture from a traditional environment to a digital environment, easy for all farmers who access this project. The continuous development of the AGRODATA project and their successful implementation on farms will lead to an increase in agricultural productivity, an increase in the performance of the technologies used and a much better quality of agricultural products. The fact that these new technologies have the role of facilitating the work of farmers will also increase the protection of the environment by conserving and regenerating the resources of agricultural agroecosystems. AGRODATA in the agricultural area in the north of Bărăgan will lead to the development of an online platform, to a much

faster dissemination of the results obtained in agricultural crops, as well as to a database that will provide farmers with information about pedo-climatic conditions. of their own agricultural crops, plant health, the degree of attack of diseases and pests and a series of recommendations of the specialists from the Research-Development Station for Agriculture Brăila.

AGRODATA provides farmers with instructions on the correct fertilization doses of agricultural crops, information on the irrigation system and the amounts of water needed for crops and alerts on devices on the occurrence of diseases, pests, pedo-climatic changes compromising that crop. The accession of farmers to this project is an important step for the rehabilitation of the agricultural field and the implementation of new types of non-invasive "equipment" for the environment, soil or agriculture.

Romanian agriculture has encountered many significant difficulties, such as lack of irrigation systems, changing pedo-climatic factors from one day to another, groundwater density, water deficit in soil (due to low rainfall), the application of increasing doses of fertilizers. higher and the appearance of soil acidity [18]. The growth, development and maximization of agricultural production depend (to a large extent) on the implementation of cognitive solutions, beneficial for agricultural ecosystems. While agricultural research is increasingly advanced, the use of new technologies is still viewed with skepticism and is extremely poorly implemented.

When it comes to managing real challenges, challenges faced by farmers, as well as the implementation of solid solutions based on artificial intelligence or other programs capable of capturing data from soil sensors, drones that create orthoplanets, AGRODATA is a pawn in the implementation of new technologies in agriculture.

These new technologies have the role of reducing the costs that farmers always bear, before discovering the benefits and advantages of digitization platforms for agriculture. Solutions for these must be affordable, inexpensive and successful, so that manufacturers of digital systems and platforms can ensure that technology reaches all farmers [13]. An open source platform for farmers would provide them with affordable solutions, resulting in a rapid adoption of new technologies and their greater penetration into farms [10].

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