STUDY ON PRECISION AGRICULTURE IN ROMANIA

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Abstract: *At present, there are very complex agricultural systems in Romania. The complexity of the systems is due to both natural and socio-economic conditions, and the level of development of science and technology that has accompanied the evolution of human society. Literature counts a large number of agricultural systems and their names are rooted in their specific works. The necessity of sustainable agriculture and of a clean environment has appeared because of the threat by the chemisation of agriculture. Implementing sustainable agriculture allows clean natural environments and protects fragile areas. Working methods in agriculture are changing and the need for the latest technologies meant to increase productivity and incomes is higher than never. The most frequently used agricultural systems in the world are conventional agriculture, biological agriculture, organic agriculture, biodynamic agriculture, sustainable agriculture, and precision agriculture – depending on the technologies used, on their intensification levels, on specialisation, on the amount and quality of biomass, on the type of relationship with the environment, etc.*

Keywords*:* precision agriculture, agricultural system, sustainable agriculture, ecological agriculture

INTRODUCTION

Precision agriculture is the most advanced of all types of agriculture; it is practiced in the most developed countries of the European Union and in the United States, on smaller areas; it relies on the most modern control measures of the quality of different environmental resources, on the optimum application of all technological components thus ensuring a rigorous control of the possible factors that could degrade the environment

MATERIALS AND METHODS

Taking into account that precision agriculture is a relatively new field of research in Romania, the study materials necessary for such a research are relatively scarce. Most of the information and knowledge concerning this type of agriculture belong to Spain, a country where precision agriculture is widely practiced.

The working methods used in the carrying out of the present research are analysis and observation.

RESEARCH RESULTS

Precision agriculture is an agronomic concept of agricultural plot management based on the existence of significant field space variability. This type of agriculture needs diverse technological tools such as Global Positioning Systems (GPS), remote sensor systems (tele-detection), aerial and/or satellite images, and Geographical Information Systems (GIS) to estimate, interpret, evaluate, and understand these variations.

This type of agriculture helps evaluating with more precision optimum planting density and, consequently, fertiliser use, water resource management, in the sense that it

predicts with more accuracy crop production and automatic harvesting practices. Similarly, the use of these technologies contributes to the making of more proper decisions regarding technical, production, economic, and environmental managementă[10].

Starting with the middle of the 1990s, precision agriculture has been increasingly seen as a management tool in agriculture (for the beginning, in fruit culture and viticulture).

Later, these techniques were spread in industrial and cereal crops such as wheat, maize, rice, and sugar beet. The use of this technology improved significantly production efficiency in orchards and vineyards, reducing rather considerably the environmental impact. Several researches showed the contribution of such instruments to the diminution of production costs, energy and water consumption, as well as to the specific management of orchards.

In practice, the sue of precision agriculture means producing, with proper tools, relevant data on the production process in each sector of the field (soil fertility, crop productivity) and their spatial location (i.e. the field measured information of a known area through a system of coordinates on the specific location of the information). This information is stored in a database and it allows the definition of sub-areas that are subjected to specific area management.

Therefore, precision agriculture allows the diminution of the smallest analysis unit in decision-making and differentiated management at a much lower level of plot. National and international experience shows that there are a series of variables of interest that could be used to delimitate differential management areas in crops, orchards, and vineyards. Among them, the most used have been the mapping of the vegetative expression of vigour, electric conductivity of the soil, and yield.

Precision agriculture has the potential of improving profitability and sustainability of the land through the following:

- Reducing costs and increasing efficiency in the use of production factors;
- Improving control systems;
- Differentiating products;
- Ensuring food safety;
- Ensuring environmental benefits (Lowenberg-DeBoer and Boehlje, 1996).

In most cases, precision agriculture tends to increase yields and reduce the relative use of the inputs compared to the initial technology (Zilberman, 1996).

The value of precision agriculture is ultimately given by the success in space-time management in all the fields related to agricultural production. Consequently, it has implications on farm profitability and environmental protection (Pierce and Nowak, 1999).

The profitability of precision agriculture relies in the value of the application data and not in the use of technology. In this sense, it is worth mentioning that information is an important source of strategic competitive advantages on agricultural exploitations. A good system of decision-making should rely on good information that need to be characterised as timely, exact, objective, comprehensive, understandable, and convenient. Precision agriculture has the potential to supply this type of information in decision-making (Lowenberg-DeBoer and Swinton, 1997).

Environmental pollution by agriculture needs the presence of pollutants capable of carrying air or water through suspension, volatilisation, or dissolution. Potential benefit lies in the ability of precision agriculture to reduce certain inputs that affect the mobility or persistence and/or regulation of the mechanisms responsible for the transport. The environmental benefits of precision agriculture are:

- Diminution of nutrient amounts when the levels or feeding capacity are enough to meet nutrition requirements in crops;
- Diminution of the amounts of pesticides;
- Diminution or avoidance of the amounts of nutrients or pesticides that endanger the crops;
- Increase of erosion control or diminution of erosion through land cultivation and waste management;
- Establishment of buffer areas in the field for the conservation of biological diversity and detection of pollutant transport in surface waters.

The environmental-related issue most studied in agriculture these last years has been water contamination with pesticides. Water pollution by fertilisers has dramatic effects on human health and ecosystems (eutrophication).

Conventional management of nitrogen fertilisers consists in assuming soils are homogeneous and fertiliser rates are even. Despite all this, fields are heterogeneous from the perspective of soil features, slope, fertility, potential yield, contamination potential, pest distribution, and crop quality. Applying nitrogen evenly cause over-application in certain areas and under-application in other areas which causes yield and quality loss in crops and an increased potential in nitrogen pollution.

Recent discoveries in the precise management of fertilisers allow agriculturists to obtain detailed information regarding the space features of their properties, which allows fertiliser management to be applied depending on the crop requirements. This has the potential of improving yield, of reducing fertiliser costs, and of reducing nitrogen wastes in the soil.

To reduce nitrogen amounts in agricultural systems, we need to reduce application rates and change application practices to improve efficiency.

They estimate that precision agriculture has an effect of the sector structure from the perspective of the promotion of vertical integration, of the automation of the decision-making process, of the improvement of monitoring of labour force, and of the facilitation of the interaction between agriculturists, clients, and suppliers. Some authors have called these effects "industrialisation of agriculture" (Zilberman, 1996; Lowenberg-DeBoer and Swinton, 1997; Olson, 1998).

Adopting precision agriculture needs new competences in the field of specialised human resources, particularly in hardware and software management. This opens new opportunities of agricultural jobs. The use of computers needs communications infrastructure which offers better rural development opportunities.

Precision agriculture also has a business potential for the producers of machines and equipment as well as for the specialised software companies that offer jobs related to data collection and processing.

CONCLUSIONS

Since the impact of conventional agriculture is on the different environmental resources – soil, water, air, flora, and fauna – there appeared agricultural systems that protect both soil and environment, such as precision agriculture. Choosing the agricultural system depends on the level of technical equipment and of professional knowledge, on mentality and education in general, and on humans' respect for nature and environment.

Applying precision agriculture offers the opportunity of carrying out research activities on farms. General data are useful in the complete knowledge of the factors that affect agricultural production.

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