

AGRICULTURAL SCIENCES

IMPORTANCE AND BENEFITS OF TECHNOLOGY IN AGRICULTURE

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Abstract

Rapid technological progress in agriculture has a tremendous impact on the agricultural sector. New satellite technologies in agriculture occupy a leading position and help more rationally manage resources, optimize field processing and increase their productivity. Higher yields and lower operating costs lead to increased income for agribusinesses. In addition, modern agricultural technologies to increase yields optimize the profitability of agricultural enterprises. Farmers successfully combine time-tested and new farming methods.

Keywords: agriculture, modern, technology, farmer, profitability

Introduction

The development of the modern agricultural sector occurs in several directions simultaneously, with the main focus being on the introduction of new technologies in agriculture. The use of best practices helps improve agricultural sustainability through smarter and more informed management decisions.

In addition, modern agricultural technologies to increase yields optimize the profitability of agricultural enterprises. Farmers successfully combine time-tested and new farming methods. For example, the sequence of crops in a crop rotation can be effectively planned using digital agriculture technologies to monitor field productivity based on satellite imagery.

New technologies in the agricultural sector (agritech) cover a wide range of industries and technical means aimed at increasing the productivity of agricultural enterprises. New agricultural technologies include a fleet of agricultural machinery, robotics, computers, satellites, drones, mobile devices and software. The use of big data analytics and artificial intelligence (AI) is another example of the adoption of innovative technologies in agriculture.

New technologies for the agricultural sector

New technologies for the agricultural sector are designed to simplify the work of agronomists and increase its efficiency. New, and sometimes completely innovative, agricultural technologies are improved and appear every year. As the agricultural business continues to modernize and grow, it is increasingly important for agricultural consultants, food processors and technologists to keep up with progress and understand advanced agricultural technologies.

Irrigation, application of fertilizers, pesticides and other agricultural inputs at large agricultural enterprises no longer occurs "by eye" or in equal quantities throughout the entire field. Thanks to new technologies

in agriculture, agronomists can apply only what is required on a particular site, and also carefully select the right treatment for each crop.

The introduction of new smart farming methods benefits everyone in the agri-food chain. The use of the latest technologies in agriculture to optimize and automate agricultural operations and field work can significantly save time and resources. Let's name the main advantages of using new agricultural Technologies[1]:

- Using irrigation water, fertilizers, pesticides and other resources in smaller quantities allows agricultural producers to reduce costs and retain more of their profits;
- reducing the volume of chemical runoff from fields and preventing pollution of water bodies mitigates the negative impact of farming on the environment and helps to increase the sustainability of agriculture;
- increasing productivity while reducing labor costs;
- simplification of interaction between participants in the agricultural process and coordination of their actions using mobile devices, new specialized applications or web resources;
- facilitating access to agricultural insurance and financial services, as well as market and technology data;
- minimizing losses due to the invasion of field pests, natural disasters and adverse weather conditions in the fields using permanent agricultural monitoring systems at reasonable prices;
- increasing the income of agricultural enterprises due to improving the quality of agricultural products and strengthening control over their quality;
- timely detection of nutrient deficiencies in plants and informing agricultural producers about the

type and quantity of necessary fertilizers and other agrochemicals for processing crops and increasing their productivity;

- The ability to predict potential problems in the field through new capabilities to visualize production patterns and patterns resulting from the application of new methods for analyzing current and historical field data.

Estimating overall crop yields helps farmers more accurately budget for the new crop growing season and better prepare for unexpected situations.

The new technology of precision or smart agriculture, also known as agriculture 3.0, has arisen from the need to monitor and more effectively manage all agricultural production resources used. The desire for precision agriculture and the introduction of appropriate technologies has given impetus to the development of new methods and tools for agriculture[2].

Era 3.0 became technically feasible through the use of a new global positioning system (GPS) satellite. In particular, the GPS system helps to find unwanted changes in a given crop growing area, which allows for more efficient use of available resources. The concept of sustainable agriculture and research in the field of automated field cultivation rely heavily on GPS technology and the new capabilities of this system.

New precision agriculture technologies that use GPS data help improve productivity and reduce wasted input costs such as seeds, fertilizers, pesticides and fuel. The GPS system not only provides location-based field information, but also simplifies the coordination of operations between individual pieces of agricultural equipment and the maintenance of records of completed field work on specialized platforms[3].

This new technology has a variety of applications in the agricultural sector:

- monitoring and management of field work;
- collection and analysis of data from the fields;
- precise sampling for soil analysis;
- crop mapping;
- navigation and control of new agricultural machinery;
- operation in conditions of poor visibility, for example during heavy rain or fog[4].

The transition from smart to connected farming clearly illustrates the rapid development of agriculture at the turn of the 20th and 21st centuries. Autonomous machines, sensor-equipped robots, augmented reality (AR), Internet of Things (IoT), drones and satellites are integral components of the new generation 4.0 technologies for agriculture.

A new approach to decision making in the agricultural sector is now based on data that is stored in the cloud and accessible through digital tools. With these insights, farmers and other agricultural industry stakeholders can make better decisions.

Agriculture 4.0 is born in the era of widespread automation and the use of digital technologies. The development of new agricultural technologies is becoming increasingly integrated and networked, making it possible to optimize all stages of the production process and improve monitoring, control and business management processes.

Robotic agricultural labor technology is a promising new workforce option for precision agriculture[3]. Autonomous operation of robotics will allow continuous field management, as well as increased productivity and efficiency of agriculture, since robots are able to collect information about their surroundings on their own site. Today, autonomous robots, controlled remotely using telemetry, are the most well-known and successfully used new agricultural equipment.

Digital Farming

Digital agricultural technologies are the next generation of new farming methods and tools aimed at maximizing yields and other agrotechnical indicators. These new technologies include 5G mobile communications, which are currently developing rapidly and will improve the coverage and accessibility of the latest technologies in agriculture around the world.

Compared to previous farming methods, new digital technologies in agriculture have the following advantages:

- efficiency of data collection: how much data can be collected over a given period of time or specified area;
- data accuracy: to what extent the obtained indicators correspond to the truth;
- Timeliness: How quickly captured data is converted into actionable information and made available to end users[5].

During the production process, farmers face a number of problems such as pest attacks and plant diseases. The weather factor in agriculture should also be taken into account: meteorological anomalies can cause serious damage to the crop. However, new digital technologies make it possible to minimize negative consequences. At the same time, with the help of new technologies, farmers can control those agricultural aspects that directly depend on them, and as a result, increase their profits. In particular, digital technologies in agriculture help to obtain an informed answer to the following questions:

- what types of crops to grow;
- how to optimally alternate crops in crop rotation;
- how often and in what volume to use water for precision irrigation;
- when to apply fertilizers and plant protection products, what and how much;
- which treatment is best suited for a given soil type.

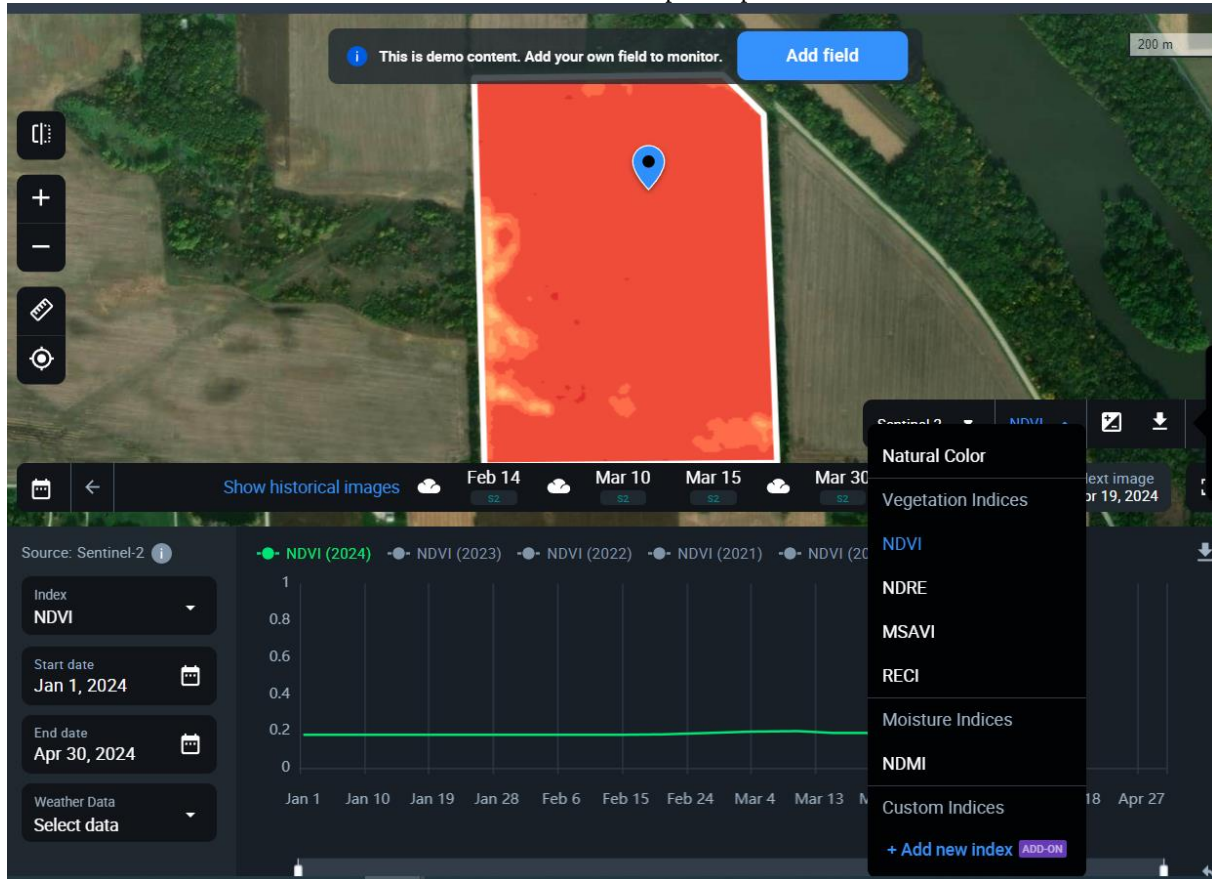
The competitive advantages of agricultural enterprises are ensured by the use of modern software, remote sensing technologies (especially high-resolution satellite images), proximal sensors, new means of communication and risk forecasting algorithms based on accurate data[5].

The use of big data in new agricultural technologies has led to intensified information flows, increased speed and accuracy of analysis and, as a result, increased the efficiency of decision-making processes and strategic planning.

Analysis of historical data about the field allows us to foresee the possible consequences of certain phenomena and factors, assess risks and develop an optimal action plan.

Information technology in agriculture is constantly improving, and specialized platforms can collect and store more and more data about fields. Relative humidity, nutrient content, soil pH and moisture, and historical weather data are just a few of the indicators that can be extracted using satellite technology in agriculture.

In particular, the EOSDA Crop Monitoring platform contains extensive information on soil moisture values at the surface and in the root zone, vegetation productivity, crop types, field height, weather conditions (historical precipitation and temperature). On this platform it is convenient to plan and keep records of completed field work (watering, sowing, harvesting), analyze the size of the field and harvests of previous seasons. Based on data in a simple and accessible format, platform users can detect risks, as well as plan crops and predict future harvests.



The functionality of EOSDA Crop Monitoring finds practical application both in individual farm enterprises and in agricultural cooperatives.

Geographic information systems (GIS) are an emerging and essential tool for storing, analyzing, and visualizing spatial data for precision agriculture needs. One of the most important aspects of the application of GIS technology in agriculture is the collection of information about crops, soil, climate and topography of a region using satellites and drones. In addition, it is thanks to new GIS technologies used in agriculture that the combined use of GPS applications and smart farming tools for optimal distribution of fertilizers and pesticides becomes possible[3].

Using new GIS technologies in the EOSDA Crop Monitoring platform, users can create field productivity maps based on a baseline NDVI index over several years. Using these yield maps, you can accurately determine the most productive areas of the field, as well as low-yield areas that would be advisable to fertilize or increase field productivity by other methods.

Applying the correct amount of fertilizer to the soil can be difficult, but yield maps can help with the

challenge. Thus, new technologies in agriculture not only help reduce financial costs for the purchase of fertilizers, but also prevent soil and groundwater pollution due to inappropriate use of chemicals.

Innovative Technologies in Agriculture

Technologies for the agricultural sector have come a long way in development and are used not only to perform the main stages of the agricultural process: sowing, growing and harvesting.

The agricultural sector has seen a number of major advances in recent years, from improved seed viability to improved planning and processing of agricultural products. New agricultural technologies also help optimize planning for the sale of agricultural products and improve logistics solutions for their delivery to the end consumer.

Rapid progress is also being made in the development and application of agricultural software and new technologies that facilitate not only field work but also the management of various components of the food supply chain. If previously it was necessary to personally go to the field for inspection, now this can be done

remotely. Modern technologies for processing Earth remote sensing data serve this purpose perfectly.

Although modern agriculture benefits greatly from the development of new technologies in terms of increasing efficiency, reducing costs and increasing yields, there is another side to the coin associated with large-scale extensive agriculture. The most significant disadvantage of new farming technologies is the detrimental impact on the environment. The harmful effects of new agricultural technologies on ecosystems are due to the following factors:

- contamination of soil and water resources as a result of large-scale use of pesticides;
- reduction in biodiversity due to the extirpation of plant species characteristic of the region as a result of crop cultivation;
- greenhouse gas emissions resulting from deforestation for the purpose of plowing agricultural land and the excessive use of new agricultural machinery in the future[2].

The harmful effects of new technologies on the agricultural sector are not limited to environmental issues. The introduction of new technologies in agriculture also causes certain difficulties for agronomists and other workers in the fields, namely:

- farmers who do not have the necessary education and practical experience cannot effectively use new technology and software, and therefore are not unable to benefit from the use of modern agricultural technologies;
- the cost of maintaining new equipment is high;
- Application of chemical fertilizers and pesticides can harm the health of farmers and other workers who work in the fields[6].

It is clear that we cannot completely abandon new agricultural technologies as they help meet the food needs of a growing global population. However, the negative consequences of new agricultural technologies can be mitigated by using and improving precision farming methods that do not harm the environment.

Because new agricultural technologies can reduce or even minimize the negative impacts of traditional farming methods, they help solve a wide range of environmental problems. In this way, intensive farming enthusiasts can get two birds with one stone: increase their competitiveness and contribute to the long-term well-being of our planet's population.

Conclusion

In the era of information discoveries, new technologies are increasingly being used in the agricultural sector. Agribusinesses are using modern technology to optimize field management, and this is just one of many examples of how innovation is driving progress in agriculture.

The volume of fertilizers, pesticides and other agricultural inputs used can be reduced with the help of new agricultural technologies and appropriate software. Another advantage of innovation is that new farming technologies help reduce emissions of carbon dioxide and other harmful substances that pollute the environment. This achievement was made possible by streamlining the agricultural production process and eliminating unnecessary steps. The yield of the resulting crops can be further increased through precise application of fertilizers.

In addition, new methods of mechanization of agricultural processes increase the productivity and efficiency of agribusiness at all stages of agricultural production, in particular during sowing, harvesting and marketing of agricultural products.

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