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# USE OF GEOINFORMATION TECHNOLOGIES IN AGRICULTURE ON THE EXAMPLE OF CHERNIHIV REGION (UKRAINE)

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**Annotation.** The article examines the use of geographic information technologies in the Chernihiv region in the field of agriculture. The results of research indicate the use of GIT in the system of research, evaluation and use of agriculture in Chernihiv region. The authors highlight the main features of geographic information systems used in Chernihiv region, which are a multifunctional solution for solving a wide range of agricultural problems, namely: centralized management of the cartographic database of the agricultural enterprise; control over the performance of agricultural work in the fields; assessment of soil quality, their potential yield, agroecological condition, degradation processes; automation of the process of reporting, planning and forecasting the development of agricultural land and others.

**Key words:** geoinformation technologies, agriculture, Chernihiv region.

**Introduction.** Today, in industrialized countries, agriculture is placed on an industrial basis. This means not only the use of powerful agricultural machinery, highly efficient chemicals and agronomic methods, but also the involvement of the latest computer technology. The practice of agrarian reforms in Ukraine has proved the need for a radical restructuring of the entire system of economic relations, which covers the simultaneous production, distribution, circulation and consumption of agricultural products. Effective use of private property is impossible without the formation of an effective agricultural market. In agriculture, the introduction of information technology has lagged far behind industry, but now we can see mass computerization in agriculture in the Chernihiv region (Ukraine).

Agriculture is a branch of the national economy aimed at providing the population with food and obtaining raw materials for many industries. The industry is one of the most important, represented in almost all countries. Chernihiv region is one of the leading regions of Ukraine specializing in food production.

Chernihiv region has significant resource and labor potential for further development of agriculture. The importance of the agro-industrial complex lies not only in meeting the needs of people in food, but also in a significant impact on employment and the formation of export potential. Traditional agricultural tools are indispensable compared to computers and software, but the latter can be a source of valuable information on their optimal use. Solving such tasks as controlling the volume and timing of fertilizers, pesticides, management of irrigation processes, etc, requires significant effort, due to the collection and maintenance of information documentation on large areas over a long period of time. The use of geographic information technologies in agriculture guarantees the accuracy, completeness and relevance of the original data [2].

**Aim.** Investigate the use of geographic information technologies in the Chernihiv region in the field of agriculture.

**Materials and methods.** In the process of studying the use of geoinformation technologies in agriculture of Chernihiv region, statistical data and geoinformation technologies were used (QGIS 3.4.15 software).

**Results and discussion.** Chernihiv region has significant potential in the field of agriculture. The total area of agricultural land is 2,068.4 thousand hectares or 64,8% of the region's land. Agriculture in the region continues to be a significant segment of the economy, its share in gross value added increased from 18,4% in 2015 to 20,8% in 2019 [6].

The agricultural complex of the region has 1014 agricultural enterprises of various forms of ownership and management, including 298 business associations, 139 private enterprises, 28 cooperatives, 482 farms, 9 state enterprises, 58 enterprises of other forms of management, as well as 159.7 thousand personal units. peasant farms (Fig. 1).

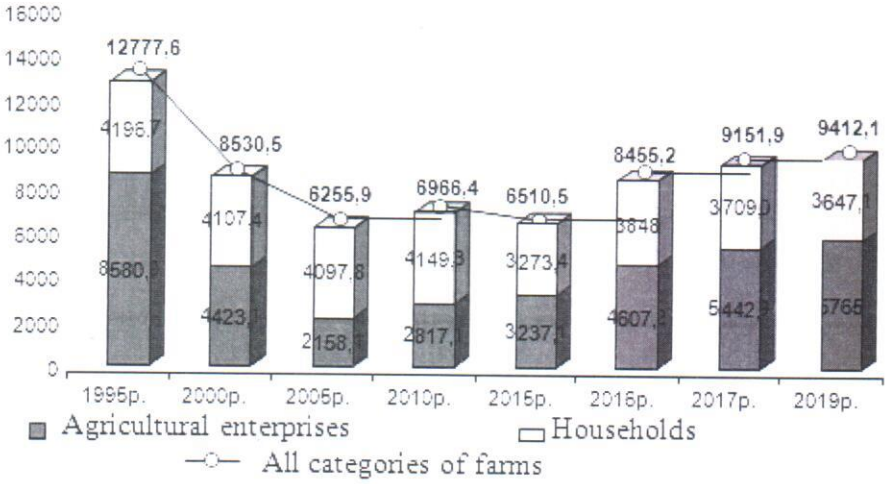


**Fig. 1. Agricultural complex of Chernihiv region**

The main specialization of the region's crop industry is the cultivation of grain and industrial crops, fodder production, animal husbandry - dairy and meat cattle breeding and pork production.

The peculiarity of the use of information technology in agriculture is that almost all the data used are geospatial. For example, if the task is to analyze the distribution of soil moisture according to yield, then all the data provided must be in one coordinate system and have the required coordinate accuracy. Only specialized programs, namely geographic information systems, can process such data. The main feature of such systems is the integration, maintenance and analysis of various types of geospatially distributed indicators and descriptive data.

Geographic information systems (GIS) are used to create and maintain land and water inventories, property registers, environmental and climate monitoring, emergency management, industrial risk assessment, analysis of the relationships of various factors affecting crop yields, information on which are based on geospatial data [3]. In essence, GIS is a combination of electronic maps, databases and tools for their maintenance and analysis. The capabilities and flexibility of these systems ensure their suitability both across the country and at the level of individual farms (Fig. 2). And this is how these systems are used today by leading agricultural enterprises in the Chernihiv region.

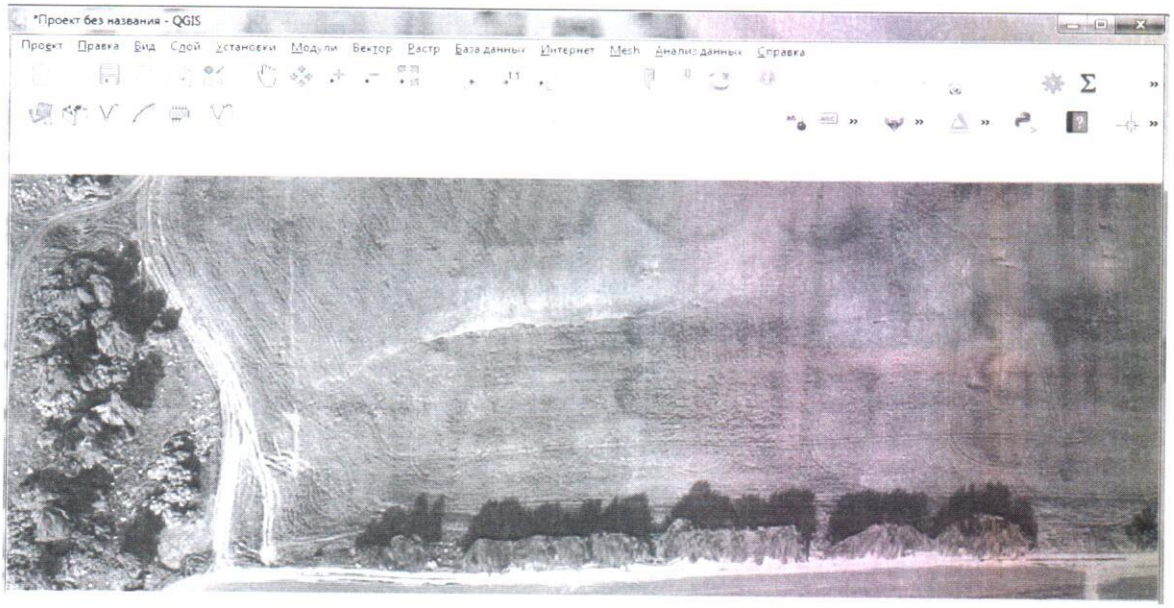


**Fig. 2. Photographic plan of the land plot, under agricultural activity (Bakhmatsky district, Chernihiv region)**

Geoinformation technologies are used by agricultural enterprises of Chernihiv region. The main sources of source data for agricultural geographic information systems are direct measurements in the fields with subsequent interpolation and image processing from aircraft and space satellites. The advantage of such data is the high accuracy and reliability of the results, the ability to measure various indicators in direct contact with the ground. The disadvantage is the significant cost (use of paid licenses), especially when it comes to large areas. Data from space and altitude aerial photography allow to control the amount of biomass, uniformity of plant growth, soil moisture and other indicators.

The use of geographic information systems and space and aerial survey data is possible at different levels of agricultural management. At the state level, it is possible to maintain a unified geographic information system used to forecast yields in the country as a whole, assess favorable and unfavorable agro-climatic factors, keep a general record and create a cadastre of agricultural land, monitor long-term trends and strategic planning [4]. At the state level, GIS can be used to ensure the effectiveness of protection of nature reserves, planning measures to protect these areas from the adverse effects of the agricultural sector.

Geoinformation data can be transferred from the state to the regional level. Both general data from selected areas and space survey data can be used in state geographic information systems. The presence of an independent and objective source of information in the form of data from space images allows to monitor the implementation of national agricultural policy, to verify the compliance of products supplied from places of information, the actual situation [5]. The state center can not only use such data itself, but also provide them for use to regional centers. And not only the initial data, but also the results of their processing, more suitable for use in the field to solve specific problems.Geoinformation systems at the regional level solve the problem of accounting for agricultural land, determining the value of land on the basis of many factors, monitoring the activities of agricultural enterprises, determining damage and compensation in emergencies, cooperation with emergency authorities, etc. [5]. Regional agricultural administrations use geographic information technology to provide advisory services directly to those involved in land cultivation. It is expedient to carry out the analysis in a complex from all region that will allow to receive full and exact initial data. At the same time, the cost of obtaining and processing data will be distributed among a number of farms in the region, which will reduce their costs in the region and will further contribute to the growth of economic efficiency.

Geographic information systems allow you to analyze a variety of factors. For example, topographic analysis allows to build objects on the basis of digital relief models of the map of slopes exposures, values of slopes, to determine insolation

coefficients; hydrological modeling - to determine the directions and intensity of surface runoff, forming a basis for assessing the impact of agricultural activities on the environment. Based on topographic analysis and cartographic data of the soil cover, it is possible to build maps of erosion potential. Means of geostatistical analysis allow to detect spatio-temporal dependences of yield on a number of factors, such as moisture, acidity, composition and other characteristics of soils, time and volume of fertilizer and pesticides, and many others [4]. In general, GIS analytical tools allow solving the chain of tasks of increasing the sustainability of agricultural production and reducing its costs. It is most expedient to conduct this analysis in regional centers, which will be able to provide the results of the analysis to farms in order to increase their efficiency and profitability. Developed analysis capabilities and high power of modern computer technology have led to the emergence of "accurate" agriculture, which collects data and analyzes the efficiency of agricultural production in small areas, and compiled, according to the data, statistics allow to take into account variations in soil characteristics. hydrological regime and other indicators [1]. On the basis of such analysis, optimal irrigation regimes, application of fertilizers and pesticides, organization of specific crop rotation, and other agricultural works are proposed for each small area of agricultural land. The significant popularity of this technique is due to its high efficiency, while other techniques have almost exhausted their potential to increase yields and product quality. Processing and analysis of data used in this approach is impossible without the use of geographic information systems, because they provide the required level of functionality.

**Thus, geographic information systems used in Chernihiv region are a multifunctional solution for solving a wide range of agricultural problems, the main of which are [2, 6]:**

- centralized management of the cartographic database of the agricultural enterprise (systems are suitable for creating and storing information about the boundaries of land and agricultural lands, cartograms of agricultural soil groups, crop rotation projects, agro-technical passports of land plots, orthophotos, land allotment projects, digital models, digital models);

- control of agricultural work in the fields, tracking of crops in terms of crops and fields based on aerial and space images (WMS / WMTS);
- assessment of soil quality, their potential yield, agro-ecological condition, degradation processes (creation of classifications of agricultural lands, allocation of especially valuable soils, nature of soil cover, distribution of lands by steepness and exposure of slopes, pollution by chemical products);
- automation of the process of reporting, planning and forecasting the development of agricultural land and others.

**Conclusions.** The use of geographic information technologies makes it possible to visualize data on the current state of land resources in various areas, which contributes to the creation of an optimal model of land use potential in agriculture.

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