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CROP MODELING AND USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES IN AGRICULTURE

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Abstract: *In view of farm informatization, the authors offer an overview of information and communication technologies (ICT) and crop modeling systems used in agriculture, describe their operating principles, and present the comparative advantages. The paper concludes that the use of ICT and crop modeling tools opens up great prospects for the future of agriculture.*

Keywords: *information and communication technologies (ICT), informatization, mechanization, agriculture, unmanned aerial vehicles (UAVs), productivity.*

At present, with the development of information technologies, mass informatization, introduction of new technologies, the Internet is being used in almost all spheres, and agriculture does not remain on the sidelines. The introduction of new technologies in agriculture opens up huge prospects, such as crop forecasting, 3D mapping, satellite monitoring, and many others. Also, one of the directions of further informatization is the use of information and communication technologies (ICT).

First, we need to understand what the term "ICT" means. It is often confused with IT – technology, but it is not exactly the same thing. The term "ICT" emphasizes the work with information and unified communications, such as telephony, the Internet, and others. There is a great emphasis on the exchange of information

between sources, analyzers, performers, and other links in the chain of the entire system [2].

ICT used in agriculture can include many things: various devices, services, networks, and applications. Also, at present, ICTs can be divided into advanced technologies and traditional ones. Advanced technologies include “big data”, cloud computing, artificial intelligence, the Internet of Things, and machine-to-machine (M2M) interaction. Traditional technologies are radio, telephony, mobile communications, television and satellites.

Let's look at a few simple examples to understand how it all works. Let's say that soil moisture sensors are installed in the fields and they collect information about the moisture content in the ground. It often happens that in some areas there is not enough moisture, and in others, on the contrary, there is an excess of moisture. These data are sent to specialized applications for farming, which also have maps that were compiled by UAVs using aerial photography, and when combining these data, it will be clear in which areas you need to water plants, and which do not need to spend water and other resources [4-5]. Thanks to the constant exchange of information in real time, you can understand exactly where and what care different crops need, what state they are in, and much more. Possession of information allows you to correctly manage all resources and get economic benefits from it, thanks to reduced costs and rational use of resources.

In agriculture, information access and communication means have always been of great importance. There are many different indicators that farm managers need to know in order to successfully run their farms. These factors include crop cultivation, water management, fertilizers, pest control, harvesting, post-harvest operations, food safety and quality management, and others. And all this information can be possessed and managed more effectively with the use of special equipment, in our case, satellites, unmanned aerial vehicles (UAVs), and ICTs.

Also, one of the advantages of implementing ICT in agriculture is attracting young people to this area. In today's society, the majority of young people are more interested in information technologies than in growing various plants, and thanks to the introduction of ICT, they will have an incentive to work in this area and develop national agriculture.

The use of ICTs requires special equipment and software, but despite the additional costs of implementing ICTs in agriculture, the payback will be achieved in a very short time by optimizing and rationalizing the required costs.

Technology of crop modeling is another innovation of ICT. Thanks to special algorithms, it is possible to calculate the state of the "soil – plant – atmosphere" system in dynamics with a daily step during the entire growing season from sowing to harvest. This technology uses the following input data: meteorological information, information about the technology used, soil parameters and characteristics of the cultivated crop, and provides access to such features as crop yield forecast, assessment of the phenological development rate, research and selection of the best agrotechnical solutions [1].

We can consider two examples: those of the Russian AGROTOOL simulation system and of the foreign ORYZA system. Based on special algorithms, they can

make a dynamic crop model, taking into account almost all factors that can affect plants during the growing season. However, the ORYZA system specializes only in rice, and AGROTOOL can calculate both spring and winter cereals, as well as root crops and perennial grasses in a single environment [1].

Modeling in the AGROTOOL environment describes the dynamics of the development of a hypothetical horizontal-homogeneous crop, providing stratification by a single vertical coordinate. The system takes into account the following factors: radiation and heat balance of soil and crops, the formation and melting of snow cover, interception of short-wave radiation and photosynthesis of the crop, the thermal regime of the soil, dynamics of soil moisture content, evaporation from soil surface and transpiration by the vegetation layer and others. [3]

Such technologies are an ideal tool for solving the following research tasks: optimizing water resource management, identifying constraints on yield in specific site conditions, assessing the impact of climate change on production, and extrapolating observed data to broader time and spatial scales, which contributes to decision-making.

Conclusion. To sum up, it should be noted that all these technologies are available for all types of farms and, thanks to their use it is possible to reduce costs and optimize the operation of the farm as a whole. The availability of such tools for analysis, data exchange and modeling of various situations provides considerable advantages for modern agriculture. The use of ICTs to collect, analyze and exchange information, and the use of modern technology such as UAVs, shows promising results and significantly simplifies the life of farmers, doing a lot of work for them and performing actions and calculations that are simply cannot be performed by human efforts. The prospects of using modern ICTs and various innovative technologies in agriculture are very wide and will only gain momentum in the near future.

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FACTORS AFFECTING THE REPRODUCTIVE FUNCTION OF RUSSIAN SIMMENTAL CATTLE

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***Abstract**: the reproductive function is the most important factor in the system of economic cattle breeding. Productivity problems in Simmental cows were identified when analyzing the results of the previous studies. The factors influencing the decrease in cow's reproductive capacity are shown. These factors are: differences in the animals' genetic type, reproductive and unproductive diseases of cows, increased milk productivity of cows, as well as stress caused by such environmental factors as hypoxia, adinamia, insolation, feeding mode.*

***Keyword:** Reproductive functions, fertility, genetic type, Simmental breed.*

The Simmental breed is one of the most common breeds in Russia due to its high growth rate compared to other breeds and lower feed consumption per unit of production. The Simmental breed occupies the second leading position in the number of farm animals. According to the Ministry of Agriculture of the Russian Federation (2006) it makes up 15.3% of the total number of Russian cattle, the average milk yield of all Simmental cows being 29.87 kg with 3.71% fat content.

According to statistics, the share of cases of non-infectious reproductive diseases is 85-90% in Ukrainian cattle breeding and 60-90% in Russia. The problem of high percentage of non-infectious reproductive diseases of Simmental breed in the Russian Federation reveals the necessity to develop a methodology for improving the productivity and reproductive indicators of Simmental cattle by conducting appropriate breeding and related activities. Limiting factors of cows' reproductive ability are violation of rules and modes of feeding and watering animals, non-compliance with optimal zoohygienic parameters of the microclimate in the premises, "everything is busy-empty", technological cycle, low level of staff qualification. As a result, 50-70% of reproductive problems occur in the postpartum period, which leads to an increase in the insemination index. It means that it is not possible to complete