Features of robotization of agricultural processes

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Annotation. The agro-industrial complex, as an industry, currently faces the problems of climate change, limited water resources, soil degradation and biodiversity conservation. It is necessary to significantly increase the production of agricultural products, while it should follow the trend of sustainable development. Resources must be used more efficiently. Intelligent solutions are needed to address conflicts of interest and meet the need for healthy and nutrient-rich foods and feeds. Therefore, it is necessary to assign an increasing role to the digitalization and robotization of agriculture in achieving these goals.

At the 2nd International conference of Ministers of agriculture within the framework of the exhibition "Green week" held in Berlin on January 19, 2019, digitalization is described as a field of activity that covers digital technologies, innovations, information and communication technologies, as well as artificial intelligence. Large corporations, such as Cargill or Du Pont, invest in this area, supporting startups that make it possible to monitor the health and well-being of farm animals. For this purpose, visualizations and custom algorithms are used, which have become instructions for use by specialists of the agro-industrial complex. The estimated positive benefit is from 100 to 200 dollars per cow for lactation. Therefore, many participants of the conference stated that soon the computer and Excel tables will not be enough - you will need a separate control element for the necessary data on livestock farms and crop rotation fields [5].

A huge problem at the moment is that in many cases it is difficult to explain to the layman how modern agriculture functions. the "Greens" criticize the activation of digitalization and robotization in the processes of agricultural production. Therefore, it is important to constantly emphasize that technological progress, including in food production, cannot be stopped. A realistic view of modern agriculture should be included in school textbooks and in the curricula of all agricultural Universities.

The idyllic image of green meadows, cows eating flowers, and pitchforks in a haystack does not correspond to the current state of the industry. What is agriculture 4.0? Precision farming and animal husbandry, automation and robotics, remote access-all these are components of agriculture of the previous generation-agriculture 3.0. But only linking these technologies together is the fourth generation of digital technologies [2].

What is happening in modern conditions is quickly becoming clear that the data collected by satellites and their assessment have great potential for technical and crop innovations in agriculture. But the collection of this data in the present requires clear rules - you need to prevent their misuse by third parties. The state should play an active role here. first of all, it should develop legislation on data
management, i.e. decentralized data storage and regional networking. Centralized data storage in the cloud poses significant risks, including from the point of view of protection from failure and disruption of primary processes on livestock farms and crop rotation fields in regions with intensive agriculture [2,3,4].

One of the most important conditions is that qualified personnel are required to work in the new format. The technical infrastructure of schools, public institutions, professional development systems, as well as the training of teaching staff is significantly behind the needs of the time. It is necessary to develop educational platforms and support agricultural enterprises in the process of their transition to digitalization and robotics.

The diagram of the transition to the "figure" in the agriculture of the Republic of Tatarstan is shown in the figure (figure-1).

All this requires certain costs and, most importantly, the need to speed up the implementation processes in production. Moreover, significant cost savings will motivate such development. The possibilities of digitalization of animal husbandry largely depend on the type of animals and form of maintenance. While in pig and poultry farming technologies are primarily focused on livestock management and indoor equipment, in dairy farming the role of "front - runners" is played by sensors and individual systems - a variety of biological parameters and evaluate them-body temperature, blood pressure, heart rate or activity (mobility). A special advantage here is the constant documentation of these parameters, which makes it easier to observe animals. Large amounts of data and indicators calculated on their basis contribute to maintaining the health of the herd, and at the same time to the welfare of animals, since early detection of an emerging problem makes it possible to timely intervention [2,3,4,5, 7,8,9,10].

One of the necessary elements is the need for standardization. The question arises whether all the collected data can be used in the production of products, and how significant they are for implementation in practice. After all, the potential for their further use is certainly high, but many indicators detected by sensors require standardization, which is difficult in production conditions. Very often, data are not sufficiently linked, so it will also be necessary to bring them to common standards in the international aspect. An example is genomic selection, which began to be introduced in dairy cattle breeding in 2010 [5].

You can give examples of successful practical use of data in accurate animal husbandry, such as individual feeding, regular control milking, measurement of animal activity, electrical conductivity of milk, automatic detection of hunting, determination in space, respiratory rate, etc. But the most important thing to remember is that everyone - programmers, biostatistics, ethologists, economists, breeders, feeders, zooengineers - sit in the same boat, which certainly causes the need to take into account complex data.
Figure 1. Organization of transition of agriculture of the Republic of Tatarstan to robotics
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