Use of Computer Technologies in Animal Breeding

T A Khoroshailo¹, V I Komlatsky¹, Y A Kozub²

¹Kuban State Agrarian University named after I.T. Trubilin, 13 Kalinin street, Krasnodar, 350044, Russian Federation
²Irkutsk State Agricultural University named after A.A. Ezhevsky, Irkutsk, 664038, Russian Federation

E-mail: kubanagro@list.ru, tatyana_zabai@mail.ru, yulia_a72@mail.ru

Abstract. At the present stage of development of agricultural enterprises, one of the conditions for their successful functioning is information support, which includes the collection and processing of information necessary for making informed management decisions. An automated process control system in livestock complexes fulfills up to 80% of all emerging management planning tasks. The tasks set today already have examples of solutions in the Russian Federation. Farms, the management of which timely and accurately assesses the situation and switches to resource-saving innovative technologies, begin to use the various available capabilities of information technologies. Unfortunately, hundreds of managers are «charged» with ideas of modern technologies, but only dozens dare to start their implementation.

1. Introduction

The development of mankind has led to the need for a transition to the information society, in which a large part of the population is engaged in the receipt, processing, transmission and storage of information. A person using information technology has better working conditions, and his position becomes creative, intellectual, and so on [1].

The effective use of information technology is becoming one of the key factors in achieving and maintaining the competitive advantage of production. The formation and implementation of competitive advantages depends on how fully managers and specialists take into account when making decisions industry and regional characteristics of livestock production, opportunities for production potential, market conditions [2].

Information technologies are a unity of technical, software, algorithmic (intellectual) support and a support network and provide not only timely and high-quality analysis of the accumulated information, but also the ability to predict with a high degree of certainty the results of milk production, sales of breeding animals and meat, given the impact of innovation in selection, keeping and milking of cows, feed production and feeding [3].

Currently, software products perform arithmetic operations a million times faster than humans. And these features of information processing can be used by every farm in our country. However, many specialists are still not sufficiently aware of the possibilities, advantages and effectiveness of using automated production control systems [4].

The implementation of the Digital Agriculture subprogram is expected in 2 stages: the first falls on 2019-2021, the second on 2022-2024. At the first stage (2019-2021), it is planned to implement pilot
projects aimed at stimulating the introduction of digital technologies by agricultural producers: «Smart Farm», «Smart Field», «Smart Herd», «Smart Greenhouse», «Smart Processing», «Smart Warehouse», «Smart Agricultural Office», «Effective hectare», «Effective head» and others. During this period, the process of determining dynamic seasonal KPIs by agricultural industry is formed and ensured. Piloting takes place with the participation of the information system of the Analytical Center of the Ministry of Agriculture of the Russian Federation, which consolidates the data of several state information and analytical systems: Central Information and Analytical System of Agriculture represents the analytics of the entire industry; Unified Federal Information System of Agricultural Lands – provides information on agricultural lands [5].

The second stage of the digital transformation of Russian agriculture will require an active phase of investment in agribusiness companies. Therefore, the main task of this stage of the program is to attract investment, primarily from private and institutional investors, in digital agricultural technologies. So the introduction of the Internet of things, consulting and data processing can only be realized with the involvement of private capital. The main investments in the deployment and maintenance of technological equipment for digital agriculture are supposed to be made at the expense of business.

In this regard, information technologies used to manage the livestock, its feeding and veterinary services are of interest.

2. The results and discussion
Dozens of programs for calculating diets based on the general methodological principle formulated in the middle of the last century are offered on the world market of software products: «Achieve the minimum cost of the diet while ensuring the given nutrition», where the specified nutrition is established by setting intervals of allowable values of components and accounted for ratios [6].

Computer programs for agriculture CORALL, designed for use in the livestock industry in Russia and the CIS. The programs automate a number of typical tasks in various areas of animal husbandry and plant growing: calculation and analysis of rations, optimization of the composition of animal feed and premixes; planning, management and analysis of the feed base of an agricultural enterprise; management of animals on the cattle farm, dairy farm; diagnosis of diseases of cattle, pigs, poultry, recommendations for combating diseases; diagnosis of pests and diseases of crops, recommendations for combating diseases and pests.

Programs together form a single complex of logically interconnected programs; however, each program can be used independently [7].

The «Selecs» program is an accounting and analytical program, which is a great help in the work of livestock. This program significantly saves your work time. The «Selecs» program performs a number of functions: input of primary information: date of calving, insemination, launch; accounting of control boards and so on; the formation of an annual zootechnical report on the results of breeding with cattle in the dairy and meat production areas, sheep, i.e. valuation; rations and more [8].

The AfiFarm Herd Management Program is the world's most comprehensive dairy and herd management software. Sensors S.A.E. AfiMilk collect real-time information. A comprehensive database of animals has been developed, with which the received information is compared. Deviation reports allow farmers to make both short-term tactical and long-term strategic decisions related to individual cows and the herd as a whole.

The main characteristics of the herd management module are: daily reproduction reports and a general analysis of reproduction; health monitoring; reports on milking performance; automatic generation of lists for veterinary examination based on certain parameters; easily compiled reports on the results of visits by the veterinarian, including diagnosis, medication, treatment.

Schedule and retest culling planning model; herd size and yield planning; easily traceable automated procedures, for example, synchronization of ovulation; improved cow breeding mechanisms; comprehensive reports, veterinary checks, etc. based on a complete database that
includes general (data on cows) and operational (collected data) information; «User formula» for building unlimited cross-references.

AfiFarm™ – it is a complete software package that in future versions will be able to support databases of many herds, provide remote data and query input, portable data terminals, network connection and other features [9].

ALPRO and DelPro Herd Management System – the comprehensive DeLaval DelPro™ system allows you to automate milking and farm management as much as possible, leaving you more time to focus on herd management operations to help you reduce production costs and increase profits.

There is no need to carry out major reconstruction of your barn or rebuild it, there is no need to retrain cows and farm specialists, there is no need to make huge investments - DeLaval DelPro™ for tethered farms has all the functions that were previously available only for milking parlors. All the information necessary for making management decisions will be provided to you in real time.

The DeLaval DelPro™ system is based on the exchange of data between milking machines and the farm management program and provides complete control over all technological processes. It is currently used to manage a herd of dairy cattle in the educational and experimental farm «Krasnodar» of the Kuban State Agrarian University.

Data exchange is carried out in real time. The milking machine and the feed carriage perform traditional farm functions in the barn; they are connected to the computer through a wireless module and a system controller. At your office, a computer with the DeLaval DelPro™ dairy farm management software collects, analyzes and tracks data from milking machines, feed wagons and other sources. The system provides you with the complete information necessary for making the best management decisions.

New – DelPro in version 3.0 The module of visits to the veterinarian provides the ability to prepare planned visits of the veterinarian, including the timely sending of invitations. DelPro generates a printout of a complete set of animal information for reference during a veterinary examination. The module provides quick and accurate recording of veterinary check results […].

One of the key elements of the DeLaval DelPro™ dairy farm management system is the new DeLaval DelPro™ MU480 milking machine. This lightweight portable automatic equipment that simultaneously provides optimal milking and supports wireless communication with a computer. The Easyline suspension transport system is of great importance for facilitating work for itself and its operators. Milking machines and animal hygiene products are fixed on special hanging trolleys that easily move along the barn from stall to stall. Hanging trolleys made of stainless steel are lightweight and easy to move to the right place. The overhead transport system is located at a height that is most convenient for both workers and cows.

The DeLaval DelPro™ system monitors when each cow should be ready for insemination, and reminds you of the need to inspect the animal for hunting, which allows you to choose the optimal time for insemination. The correct determination of the time interval will increase the chances of successful fertilization, and minimizing the number of attempts of insemination will save time and money.

Investing in a DeLaval DelPro™ system gives you integrated dairy management capabilities without the need to change milking technology. The system provides you with the information you need to provide better control of the milk process. If necessary, it is possible to program the identification of milking machines of each employee using electronics: this will allow for monitoring the work of operators. Thus, it will be possible to track the performance of each milker: for example, data on milk flow rate and milk yield show the sequence and effectiveness of preparation for milking. You can also determine how much milk each operator has milked [10].

Integrated feeding management leads to an increase in milk production per 1 kg of feed, increasing your profits; helps improve animal health - proper nutrition has a positive effect on animal health and milking performance; helps to improve the management of your dairy by monitoring the characteristics of individual animals, groups and the whole herd; saves you time by eliminating manual data entry.
Software product «1C: Enterprise 8. Breeding in livestock. Pig breeding» is intended for automation of operational accounting in farms engaged in pedigree and commercial pig breeding. The solution allows you to organize a quantitative and weight registration of animals, registration of the reproductive cycle of animals, breeding registration in accordance with Order of the Ministry of Agriculture of the Russian Federation of May 7, 2009 No. 179, veterinary registration and registration of feed. «1C: Breeding in livestock. Pig breeding» allows you to automate the basic processes and functions of the industry: recording livestock by head and mass; registration of animals by technological groups (parties); accounting for indicators of the reproductive cycle (insemination - farrowing - weaning); registration of feed and veterinary drugs; accounting of tribal indicators; calculation of industry indicators such as weight gain, number of fodder days, animal welfare, percentage of fertility and percentage of access to farrowing, etc.; Reporting on the valuation; specialized reporting [11].

Using the solution allows the leaders of the pig industry: to have up-to-date information on the number of herds and the main industry indicators for making managerial decisions; generate reports on production activities as a whole or a separate unit. Livestock specialists and breeders can evaluate livestock status in real time; efficiently carry out selection work using the built-in mathematical calculation program of expert estimates and promptly make the necessary adjustments; conduct and receive information on breeding work with animals on the farm; to track the life cycle of the technological group of animals (parties): from the moment of birth or fattening to the sale of the animal or its disposal at the meat factory; track the life cycle of each individual animal: from the animal’s entry into production, from the broodstock or from the supplier, to the sale of the animal or its disposal from the herd; receive information on the production cycle of animals at all stages: insemination, inspection (ultrasound), farrowing, weaning; to reflect all operations on the movement of the herd with the registration of the number of goals and mass; track the movement of animals in the context of groups and farms, analyze the causes of culling and death; analyze the work of individual employees and the economy as a whole; contribute to the achievement of high parameters of animal productivity; analyze herd status information through numerous reports.

Technologists and specialists of the departments of veterinary medicine and feed metering will be aware of: write-offs of drugs and feed by gender and age groups and by individual animals; analysis of data on the movement of feed and veterinary drugs; reporting on feed intake; planning of veterinary measures with the indication of drugs and doses directly during the event; carrying out case analysis and veterinary measures; cost optimization for veterinary drugs and veterinary services; reduction of orders of excess stocks and proper distribution of feed; daily operational accounting.

The automated system «Mercury» is intended for electronic certification of cargoes supervised by the State Veterinary Supervision, tracking the route of their movement through the territory of the Russian Federation in order to create a unified information environment for veterinary medicine, and increase biological and food safety.

The purpose of creating the Mercury program was to reduce the time required to complete veterinary accompanying documentation by automating this process; automatic accounting of incoming and outgoing production volume at the enterprise (refrigerator, warehouse, MPP and so on); input and storage of information on selected samples for the study of imported products; the ability to track the movement of a consignment of goods across the territory of the Russian Federation, taking into account its fragmentation; reduction of labor, material and financial costs for the preparation of veterinary accompanying documentation by replacing the protected paper forms of veterinary accompanying documents with electronic versions; minimization of human errors, thanks to the availability of ready-made forms for entering information, as well as verification of user input; creation of a single centralized database for quick access to relevant information, for reporting, search and analysis of information [12].

The selection program for selecting a group of bulls for the selection of each specific farm - MPG™ allows you to quickly sort the bulls-producers according to the desired economically useful signs: predicts the breeding value and exterior profile of future offspring; carries out a quick search for the
bull according to the specified criteria; allows you to find any bull from the global database by
registration number, nickname or seed code.

After determining the breeding goals, the criteria for selecting bulls are entered into the program. In
addition to the necessary economically useful traits, it can also be the absence of undesirable recessive
genes, origin (pedigree), seed price, etc. The program selects a group of bulls that match the specified
criteria and predicts the breeding value and exterior profile of future daughters.

MAP™ computer breeding program for corrective selection of bulls for breeding stock for
maximum genetic progress in the herd: allows you to make a forecast of the genetic potential of each
herd cow based on the tribal value of the ancestors and data on the productivity and exterior of the
animal itself; produces optimal individual consolidation of bulls, taking into account the breeding
value of each female and excluding inbreeding.

Information about the breeding stock of the farm is entered into the program by filling in the
database of AWS «Selecs» or other breeding programs. The MAP program determines the tribal value
of each female on the basis of the pedigree and phenotypic traits (exterior and productive
characteristics). Further, the program introduces information about a group of bulls that were
previously selected in the MPG program and correspond to the goals of breeding. Carrying out more
than 38000 calculations for each animal, the computer performs optimal pairing, while eliminating
inbreeding to a degree of 6.25% or less. Recommendations on the use of bulls are issued in PDF
format and in the form of Excel tables.

Additional features of the program: exclusion of unwanted recessive genes in the herd; selection of
bulls taking into account the conditions of keeping on the farm; keeping records of the seed in the
sperm bank; targeted selection of different types of animals.

The program of corrective selection of bulls for breeding stock G-MAPSM (genomic version of
MAP) based on the genomic assessment of females. G-MAP is available for any dairy farm that tests
the genome of its cows and / or heifers on a 3L or 50K chip.

Simply provide the genomic test results you have with your local Genetics Dairy Company
representative to enter these data into the program. Using the G-MAP program, you will receive
matting recommendations for any animal, group of animals or a whole herd of genomically tested
animals.

BOLT™ Consolidation Program for Group Consolidation of Bulls to Breeding Livestock to
Eliminate Inbreeding in the Herd. It is used when working with large herds. Information on the origin
of the females is loaded into the BOLT program from the «Selecs» database or the dairy herd
management program. After entering information about a group of bulls planned for use on the farm in
BOLT, the program scans the pedigree of each animal in search of closely related links between each
cow and the bulls from the list.

The BOLT report shows bulls, which are assigned to specific cows leads to inbreeding above
3.125%. If inbreeding from the use of any of the bulls in question does not exceed this threshold, the
report indicates that any of these producers can be used for a specific cow. In the BOLT program,
animals can be divided into groups, each of which has its own breeding strategy and different bulls are
fixed. BOLT makes it easy to create an attachment by exclusion for both one animal and the whole
herd (in sections, lactation, etc.). Recommended bindings can be easily imported into herd
management programs.

The Sort-Gate™ breeding program is a breeding value ranking of the breeding stock for strategic
breeding decisions. The program loads information on the origin of the female herds and data on the
actual productivity of the cows or the genomic assessment of the brood stock. It is also a good tool for
those who sell pedigree young animals.

The Calf Math™ Profit Calculation Program is a program whose name literally means «calf math»
or «calf calculation». It serves to calculate the economic efficiency of the breeding strategy in a
specific economy:

- makes it possible to calculate the financial result of breeding decisions;
- compares between the current and planned breeding strategy;
allows you to take into account the planned population growth rate.

The program includes current (production, financial) and target indicators of the economy, based on which the economic efficiency of various breeding strategies is calculated and the most cost-effective option is determined.

3. Conclusion
Thus, digital technologies in the near future will become an integral part of agricultural culture. The transformation of the agricultural sector of the Russian Federation involves the digitalization of all areas of livestock: dairy and beef cattle, pig, poultry, poultry, breeding and genetics and other industries.

The most popular and demanded areas are digitalization for the agro-industrial complex:
- Differentiated watering and sowing, fertilization, crop forecasting.
- Sensors for measuring the temperature and humidity of soil / air / products, monitoring systems for agricultural machinery and personnel, control of fuels and lubricants and cattle.
- Aerospace imagery.
- Applications and cloud services: agroscouting, accounting, management of an agricultural enterprise via mobile devices.
- ERP-systems: integration of disparate data in a single system.

Maximum digitalization and automation of all processes in agriculture, on the basis of a perceived need, will accelerate the growth of agricultural productivity, ensure a stable result of innovation and increase the competitiveness of enterprises.

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