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The effectiveness of livestock farming mechanization

The article deals with the economic analysis of the current state of milk production in Russia in comparison with the developed countries. The possibility of efficient milk production due to the advanced production technology and the methods of cow maintenance and milking are considered in the case of “Livestock Breeding Farm under the name of 50 Years of the USSR”, which is located in the Gryazovets District of the Vologda Oblast.

Dairy cattle breeding in Russia, advanced technology, the efficiency of milk production.



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The importance of the growth in livestock production is predetermined by the national interests, especially by the necessity to ensure food independence (security) of the country and to increase the consumption of high-quality foodstuff.

Unfortunately, the volume of dairy production has been reduced in Russia due to the errors in market reforms. Per capita milk production was 230 kg in 2010 vs. 376 kg in 1990. So, the consumption of milk and dairy products has been reduced accordingly. The share of import in the beef consumption is more than 70%, and it is 80-90% in some regions and industrial centers [1].

It should be noted that the Government of Russia emphasized repeatedly the need for dairy farming recovery and its effectiveness increase. However, there are no significant changes in this field because of a wide range of objective and subjective factors. In particular, the analysis revealed the fact that the growth in gross agricultural output by 1% over the last decade had been accompanied by 1.3% increase in energy consumption and 2.7% increase in electricity consumption [3]. The working conditions of maintenance staff are poor, especially in the low-mechanized farms that use outdated technologies. This situation leads to lower productivity and employee turnover.

Backward technologies are the main reasons for 60 – 65% realization of the genetic animal potential.

Fodder inputs per one centner of milk in the agricultural enterprises of the country are much higher than in the developed countries, they amount to 1.5 centners of fodder units. Labour inputs per one centner of milk with regard to individual farms of the population reach 8.5 man-hours [4].

As it can be seen from *table 1*, untethered housing is the main type of cow housing abroad; it allows the farmers to increase significantly the standards for the assignment of animals to maintenance staff and to reduce labour-output ratio. The list of factors that lead to low efficiency of dairy cattle breeding in Russia can be continued.

The analysis of the current dairy production in our country shows that the recovery of this industry and its further development can be effectively achieved only at the qualitatively new technological and technical levels. Innovations allow producers to realize fully the genetic potential of animals, use rationally fodder, energy, financial and human resources and fixed assets, as well as to produce high-quality and environmentally safe products.

The things mentioned above are referred to the state of dairy cattle breeding in the Vologda Oblast. There is a lack of adequate fodder ration in most of dairy farms, outdated technologies are used there (over 95% of technologies include tethered housing).

Farm equipment hasn't been updated for a long time, and it is depreciated physically. According to experts, new technologies produce more than 80% of market milk, although only 20% of dairy farms use them [5].

The experience in the implementation of new technologies by "Livestock Breeding Farm under the name of 50 Years of the USSR" in the Gryazovets District is worth to be widespread.

In 2011 the total number of cattle amounted to 4300 head here, including 1600 cows. Sales proceeds of goods and services accounted for 233.8 million rubles; profit was 45.3 million rubles. Gross milk production reached 11.5 thousand tons; milk yield per each cow was 7299 kg [6]. The genetic potential of cattle productivity was saturated in breeding work due to the implementation of the newest methods of breeding and the creation of a stable fodder base.

Table 1. Some indicators of milk production in the countries

Indicators	Russia	Europe	USA
1. Milk yield per 1 cow, kg per year	3501*	7250*	9219*
2. Housing methods for dairy herd, in % to the total number of cows:			
- tethered housing	85	15 – 16	3 – 4
- untethered housing	5	68 – 70	93 – 94
- stabling	10	15 – 16	2 – 3
3. The mechanization of cow milking, in % to the total number of cows:			
- into a bucket	44	10 – 12	1 – 2
- into a milk line	21	60 – 65	14 – 15
- in milking parlour	Less than 1	25 – 30	84 – 85
- by robot	Less than 0.1	1 – 2	0,5 – 1
- by hand	Over 30	–	–
4. Resource inputs per one centner of milk			
- labour inputs, man-hour	8.5	0.6 – 0.8	0.4 – 0.6
- fodder inputs, centners of fodder units	1.3 – 1.4	0.7 – 0.9	0.6 – 0.8
* Data as of 2007			

Complete feed of cows is carried on by the feed distributor Optimix. The structure of the machine and tractor fleet is improved by reducing unproductive and unprofitable tractors and increasing the number of efficient imported John Deere and Ares equipment and Claas combines. Most of the grain drying complex is transferred to be gas fueled. A full range of machines manufactured by Krone have been purchased for hay. The farm has been providing itself with high-quality vegetable feed and grain fodder for several years. Fundamentally new milking and refrigeration equipment made by company De Laval is installed on the dairy farms; three untethered housing farmyards with a milking parlor Europarallel (2x12) were run in.

The first stage of cowshed for 320 head with the use of milking robots was put into operation in December, 2008. All the technological processes such as feeding, watering, manure collection, climate control and animal care are fully mechanized and automated. The total equipment cost amounted to 28 million rubles. It included the cost of four robotic milkers (up to 100 thousand euro each), a fridge, which volumetric capacity is 7.5 tonnes, a delta-scraper, channel covering for the delta-scraper, four roof axial fans for climate control, the mats for the cow stalls, feeding stations, two brushes for cows cleaning and brushing, window curtains.

The herd of 280 dairy cattle is served by four operators, who work over 24 hours in shifts. The operators are responsible for the observation over cows' behavior inside, they ensure that the cows enter the robotic milker and keep track of computer information on the state of animals, the number of milking, milk yield per day from each cow and equipment status (not just milking). A sufficient basis was accumulated during the last period for comparing milk production costs of this technology with other technologies. First of all, there was a cut in the number of maintenance staff and, consequently, labour inputs per unit of output were reduced. In 2011, 0.43 man-hours were spent to produce

one centner of milk while 0.64 man-hours were spent in untethered housing with a milking parlor Europarallel and 1.86 man-hours in tethered housing with a milk line.

Absolute and relative costs to produce one centner of milk products are different in various types of cattle housing (*tab. 2*).

The largest share in the production cost structure in the robotic and other types of farmyards is fodder cost (up to 42%). Energy, fuel and water costs range from 14 to 16% in different types of housing. Depreciation cost varies over a wide range – from 4.6 of milking cost in parlor Europarallel up to 17.7% of robotic milking cost. This difference can be explained by large financial investment in the farmyard's construction and the purchase of equipment. These costs will be reduced as their exploitation advances. For example, if the share of robot amortization amounted to 20.1% in 2009, it decreased down to 17.7% in 2011.

The share of wages in the cost structure of animal produce is 6.2% on the robotic farms and 22.3% on the milk-line farms. This circumstance is caused by 1.5-fold decrease in the number of dairymaids and the full cattlemen displacement. At the same time, outside maintenance costs have been increased. The shares of these costs in the total expenditure amount to 9.4% on the robotic farms and 4.1% on the milk-line farms. Such facts as self-maintenance of milk lines and lower cost of spare parts influence the total cost.

Despite the high initial cost of mechanization and automation of technological processes in dairy farming, the farm continues to buy new equipment and increase the number of cattle serviced by robots. The second line of the dairy complex with 4 robots for 380 head including 280 dairy cattle was run up at the beginning of 2012.

The policy of robot milking is taken into service by the Livestock Breeding Farm "Homeland", located in the Vologda District. According to experts, robotic milking can decrease mastitis in dairy cattle due to the

Table 2. The volume and structure of costs to produce one centner of milk in Livestock Breeding Farm under the name of 50 Years of the USSR in 2011 on the bases of various technologies

Costs	Total costs		Tethered housing with a milk line		Untethered housing with a milking parlor Europarallel		Untethered housing with robotic milkers	
	rub.	% of total	rub.	% of total	rub.	% of total	rub.	% of total
Wages	178.1	15.4	279.1	22.3	92.1	9.4	74.9	6.2
Fodder	501.3	43.3	521.8	41.6	465.5	47.7	509.8	41.9
Fuels and lubricants, electricity, water	175.5	15.2	201.9	16.1	136.2	14.0	175.7	14.4
Depreciation of equipment, buildings and the main herd	108.9	9.4	58.0	4.6	117.6	12.0	215.9	17.7
Total business and manufacturing expenses	79.9	6.9	87.0	6.9	66.7	6.8	84.5	6.9
Maintenance and repairs	64.00	5.5	51.8	4.1	51.1	5.2	114.1	9.4
Other costs	49.9	4.3	55.1	4.4	46.6	4.8	42.7	3.5
Total expenditure	1157.6	100	1254.6	100	976.5	100	1217.6	100

control over the completeness of milking and the state of each quarter of an udder. At the same time there are obvious and positive social advantages of a new technology, including the decrease in the use of hard dairymaid labour and increasing prestige of workers, who are involved in high-technology operations on the farms.

Advanced regional farms have proved that it is possible to reach the level of the developed European countries and the USA in effective dairy cattle breeding. On this basis Russia can and should provide a reasonable standards of the consumption of dairy products purchased by the population at affordable prices.

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