

Intensification and innovation approach toward the dairy livestock breeding in Vologodsky District

Using an example of farms located in Vologodsky District, the article reveals the state of affairs and the ways of modernization concerning dairy cattle husbandry, which is the Vologda Oblast's leading branch of agroindustrial complex. The basis for modernization includes innovations in breeding, fodder production, feeding and milking technologies, loose cow housing, personnel training, optimal work organization at dairy farms and complexes, improvement of the quality of raw milk. All these factors promote the intensive development and competitiveness of the region's agricultural organizations.

Vologodsky District, dairy cattle husbandry, stock breeding, intensification, modernization, raw milk quality, competitiveness.



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At present, Russia's economy is undergoing the transition to an innovation type under the programme documents of federal and regional levels. Modernization of major industries, the necessity of envi-

ronmental protection and natural resources conservation are highlighted as priority issues in the Concept of Long-Term Socio-Economic Development of Russia up to 2020.

When working out the development scenarios, a target scenario was proposed, which is based on the transition of the Vologda Oblast's agro-industrial complex to innovation development. This option envisages the establishment in the medium term of the powerful research facility in the Oblast, which should become the point of technologies transfer, the source of scientific personnel and ideas. It is expected that the share of agricultural goods produced with the use of resource-saving technologies will reach 35 – 40%, and the share of food products – 70 – 80%. Livestock breeding will also experience a transition to new, resource-saving technologies. Average milk yield per 1 cow in the oblast's agricultural enterprises will exceed 6 thousand kg a year. Retaining the cow population in the agricultural sector at 98 thousand head will provide for the production of 600 thousand tons of milk to 2020. In line with the Food Security Doctrine, the main directions of state economic policy comprise:

- accelerated development of cattle breeding;
- development of scientific potential of the agro-industrial complex, support of new research areas in allied sciences and the implementation of measures preventing brain drain;
- increase in structural and technological modernization rates of agro-industrial and fishery complexes, the reproduction of natural and ecological potential;
- development of the system of training and improving the professional skills of personnel, capable of implementing the tasks of the innovation development model of agricultural and fishery complexes with regard to food security requirements [6].

The Vologda Oblast dairy cattle breeding farms introduce measures significantly increasing their competitiveness on the basis of an innovation approach. The experience of Vologodsky District is of special scientific and

practical interest, as its enterprises produce 28.5% of the total oblast milk volume, the average milk yield in 2011 reached 6397 kg (2.5 times higher than in 1990), gross milk output – 119.5 thousand tons (+ 22% as compared to 1990), the number of cows – 18.7 thousand head (-18% as compared to 1990). Labor costs per 1 centner of milk decreased from 4.69 to 1.98 man-hours (-67.8%) [5].

The leaders in milk yield are: Collective farm Rodina – 8389 kg, agricultural production cooperative (APC) Priskhonskoye – 7671 kg, agricultural production cooperative horse stud farm (APCHSF) Vologodsky – 7622 kg, APC Peredovoy – 7130 kg, agricultural production cooperative breeding farm (APCBF) Maisky – 7297 kg [1, 4]. Milk production has increased in 17 farms out of 22. The following enterprises account for the highest increase rates: APCBF Prigorodny +775 tons, or 105%; collective farm Rodina – +761 tons, or 105%; APCBF Maisky – +528 tons, or 105%; CJSC Agrofirma Severnaya Ferma – + 470 tons, or 105%; APC Agrofirma Krasnaya Zvezda – +458 tons, or 105%, etc.

The main and interrelated directions of livestock breeding intensification include selection, complete and balanced feeding, scientifically grounded production technology and the optimal organization of labour on farms and complexes [3, 8, 10]. The district farms implement activities aimed at dairy cattle breeding intensification, the main of them include:

- innovations in breeding (use of the most valuable bulls, intensive calf rearing with the use of milk acidification);
- modern technologies of silo and haylage pitting, harvesting of fodder grain crops with high humidity;
- balanced diets, including protein feed;
- technological modernization of the farms;
- improvement of the staff's professional skills.

The high organizational level of breeding work is of paramount importance [8, 10]. In dairy cattle breeding, 8 farms have a status of a breeding farm (APCBF Prigorodny, APC Peredovoy, Collective farm Rodina, APCBF Maisky, APC Agrofirma Krasnaya Zvezda, APCHSF Vologodsky, Federal state unitary enterprise scientific-experimental farm Molochnoye, APC Priskhonskoye); 7 farms have a status of a breeding reproducer (APCBF Ilyushinsky, APCBF Novlensky, LLC Projector, CJSC Agrofirma Severnaya Ferma, APCBF Teplichny, Fetinino Department, CJSC Nadeyevoy, LLC Agricultural enterprise Kurkino).

APCBF Plemptitsa Mozhayskoye and CJSC Vologda Poultry Farm have a status of a breeding farm in poultry breeding, and in horse breeding – APCHSF Vologodsky.

The share of breeding farms in the total volume of milk production equals 57.7%. At the same time, they provide milk-processing enterprises with raw milk of the highest and the first grade only.

The cattle on the breeding farms is of the highest quality. The enterprises that successfully combine animal feeding and housing with efficiently organized breeding work achieve the greatest success.

The influence of breeding farms on the improvement of pedigree and productive qualities of dairy cattle in the Vologda Oblast has increased significantly through the sales of pedigree livestock to agricultural production enterprises and the replacement of low-productive animals.

The district's breeding enterprises sell more than 1500 (about 50% of the total sales of all breeding farms in the Oblast) head of cattle annually.

The provision of pedigree cattle with high genetic potential allows for constant increase in cow productivity and milk production volumes in the region.

Breeding work with a herd of cattle is kept according to the plans of breeding work, developed for each breeding farm, as well as for the district as a whole. Breeding records are kept at a high level with the use of "SELEX" software. All the livestock is valued. In 2011, 36776 head of breeding stock and heifers was valued, including 18765 head of cows. Pure bred and fourth generation cattle comprise 99.1% of valued livestock. The number of high quality cattle is increasing each year. The number of cows and heifers belonging to "elite" and "elite record" classes equaled 95.2% in 2011. The number of cows with record-breaking productivity has increased.

The best cows produce more than 11 thousand kg of milk for 305 days of lactation (*tab. 1*).

Vologodsky District farms had 5385 cows (36%) with milk yield exceeding 7 thousand kg, 326 cows – with milk yield exceeding 10 thousand kg in 2011 (*tab. 2*).

Considerable attention is paid to young stock rearing. [8, 10]. Average daily calf performance in the best district's farms equals 650 – 750 grams. The average live weight of 10-month-old heifers equaled 244 kg, of 12-month-old heifers – 283 kg, of 18-month-old heifers – 388 kg for 2011, which exceeds the standard parameter of the breed. Over the last few years the semen of foreign stud bulls has been widely used. 9718 cows and heifers have been inseminated by the bulls improving the genetics and performance of livestock. The use of immunogenetic expertise is becoming more widespread in the region (it is carried out by the State Scientific Establishment Northwestern Scientific Research Institute of the Dairy and Meadow-Pasture Economy) of the Russian Academy of Agricultural Science) in order to confirm the origin of the breeding stock.

The leading farms have accumulated great experience of breeding work, which is being studied and used in the Vologda Oblast and other regions (*tab. 3*).

Table 1. Record productivity of cows according to their breeds for the last completed lactation

Cow's name and number	Farm	Year	Milk yield for 305 days, kg	Share of protein in milk	
				%	%
Travina 3174	APCBF Maisky	2	12812	4,41	3,5
Silva 20568	CJSC Agrofirma Severnaya Ferma	3	13539	3,99	3,54
Otvaga 5030	Collective farm Rodina	3	11847	3,99	3,33
Izumrudnaya 4320	APC Agrofirma Krasnaya Zvezda	4	10326	5,22	3,29
Stranichka 6200	APC Agrofirma Krasnaya Zvezda	3	9764	4,93	3,05

Table 2. Dynamics of the number of high-producing cows and their share in Vologodsky District farms for 2006 – 2011

Indicators	2006		2007		2008		2009		2010		2011		Difference (%)
	Head	%	Head	%	Head	%	Head	%	Head	%	Head	%	
Number of cows with milk yield exceeding 6 thsd. kg for 305 days of lactation	6448	40.3	10880	65.8	7827	49	8627	55	8536	58	8723	58.1	+17.8
Number of cows with milk yield exceeding 7 thsd. kg for 305 days of lactation	3387	21.2	4160	25.1	4497	28.2	5213	33	5285	36	5385	36	+14.8
Number of cows with milk yield exceeding 10 thsd. kg for 305 days of lactation	96	0.6	140	0.8	194	1.2	249	1.6	269	1.8	326	2.2	+1.6

Table 3. Dairy efficiency of cows of different breeds in average for 305 days of the last completed lactation (2011)

Breed	Number of cows	Milk yield for 305 days, kg	Fat in milk		Protein in milk		Average live weight of a cow, kg
			%	kg per year	%	kg per year	
<i>Vologodsky District</i>							
Ayrshire	2326	6571	4,27	280,9	3,37	221,4	510
Black motley	12511	6422	3,66	235,7	3,29	211,7	536
<i>Vologda Oblast</i>							
Ayrshire	5360	5148	4,25	219,0	3,31	199,7	471
Black motley	38297	5702	3,73	212,7	3,25	206,1	520

There are 21 agricultural enterprises and 2 of peasants (farmers) households engaged in milk production in the district. Almost all of them supply milk for the Vologda Dairy Plant.

High-quality milk (including VDP, first quality, premium, extra, classic) realized by the district farms in 2011 equaled 94.5%, which exceeds the previous year level by 5%. Fat content of milk for all farms in average amounted to 3.75%, average protein content – 3.24%.

The farms were able to achieve such results due to the high efficiency of dairy cattle breeding, the use of advanced technologies, modern refrigerating systems and well-established control over milk quality, modernization and technical re-equipment of farms and complexes [2, 8, 12].

At present, all the agricultural enterprises of the district are provided with Russian and foreign cooling tanks, their number amounts to 98 units with overall capacity of 436 tons;

130 milk line washers and coolers are in operation. There are 23 fully equipped milk laboratories determining milk quality.

Some farms in Vologodsky District (APCBF Ilyushinsky, APC Agrofirma Krasnaya Zvezda, APCBF Maisky, APC Novlensky, APC Pervodovoy) use a luminometer for determining the quality of milking equipment sanitation and quick decision-making in case of emergency. 98% of the milk realized by these agricultural enterprises for 2011 is of high quality.

The all-year stable housing and uniform feeding is used for the cattle stock in 17 farms of the district. 19 farms use 49 domestic and foreign mixing feed distributors.

Free stall cattle housing is being actively implemented. At present, 9 farms in the district have 13 milking parlors. Collective farm Rodina uses the voluntary milking system where 6 robotic milkers operate.

Vologodsky District agricultural enterprises started to modernize and reconstruct their cattle-breeding facilities in 2004 – 2005. CJSC Nadeyevoy, Collective farm Rodina, APCBF Ilyushinsky (Gridenskoye Complex), APC Novlensky (Sholokhovo farm), OJSC Zarya were the first to introduce free stall cattle housing and milking parlors. The milking parlors in APCBF Prigorodny (Nepotyagovo Complex), APCBF Ilyushinsky (Vladychnevo Farm), APC CJSC Nefedovo, APC Novlensky (Filutino Farm) put milking parlors into operation in 2006 – 2010. The peasant (farm) enterprise Torosyan opened the cattle-breeding complex with free stall cattle housing and milking parlors in 2010. APC Agrofirma Krasnaya Zvezda launched the first in the North-West of Russia advanced cattle-breeding farm with a linear installation, where the herd management system Del – Pro is used.

The reconstruction of cattle-breeding facilities, operating in the region, was continued in 2011, and the construction of new modern milk production complexes was set up. For instance, APCBF Maisky launched the

construction of a new cattle-breeding complex with free stall cattle housing and a 470-head milking parlor. CJSC Agrofirma Severnaya Ferma completed the reconstruction of Makarovo cattle-breeding complex: a 160-head cow shed with free stall cattle housing and a milking parlor has been put into operation. Collective farm Rodina is reconstructing Vasilyevskoye farm for introducing free stall cattle housing and robotic milking. The peasant (farm) enterprise Torosyan is constructing a modern maternity barn and calf-barn. All these activities, undoubtedly, are aimed at increasing production volumes and obtaining high quality milk.

Every agricultural enterprise in Vologodsky District carries out annual studies – re-certification of machine milking operators in the fields of milking technology, cattle housing and feeding. According to re-certification results, animal husbandry workers are assigned classes: 60% out of 578 machine milking operators have the title of “Master of livestock breeding” (of the first and second class). Annually, more than 300 people study in the Vologda agricultural technical college to obtain such specialties as machine milking operator, laboratory technician determining milk quality, mechanic for milking equipment maintenance within the framework of the target program “Staffing of the Vologda Oblast agro-industrial complex for 2009 – 2011” [2, 4, 9].

The Department of socio-economic development of Vologodsky District villages annually organizes the district competition of machine milking operators and in cooperation with the Vologda Dairy Plant (VDP) – the review-contest of milk quality and training seminar for agricultural specialists on improving raw milk quality. In 2011, the district initiated the contest for the best laboratory technician controlling raw milk quality. Such contest took place for the first time in October 2011 on the premises of the Vologda Dairy Plant.

The programme on the modernization of dairy cattle breeding is being implemented in Vologodsky District, its main goal is the increase of production and improvement of raw milk quality. The activities planned to be implemented in 2012 – 2015 include:

- construction of milking parlors in APC Peredovoy, LLC Prozhektor, APCHSF Vologodsky, APC Prisukhonskoye, CJSC Agrofirma Severnaya Ferma, CJSC Nadeyevo;
- introduction of five robotic milkers in the Collective farm Rodina;
- purchasing of 4 mixing feed distributors;
- purchasing of ice generators: for APCBF Maisky, APCBF Ilyushinsky, APCHSF Vologodsky;
- purchasing of 3 milk cooling tanks for CJSC Nadeyevo in 2012;
- equipping of laboratories for determining milk quality at OJSC Zarya, Vologda Oblast State Agricultural Enterprise (VOSAE) Osanovo, LLC Agricultural enterprise Kurkino;
- purchasing of instruments: somatos, lactometer, clover, luminometer, etc.;
- introduction of advanced experience: organization of seminars for improving milk quality, visiting advanced farms and studying the experience of high quality milk production.

The high quality of milk at the Vologda Oblast farms is the result of the complex work of scientists and experts, including the increase of the dairy cattle productivity, improvement of animal housing and feeding, equipping of dairy farms with modern milking facilities, product quality control.

Scientists of the Vologda State Dairy Farming Academy named after N.V. Vereshchagin, All-Russia Research Institute of Animal Husbandry in cooperation with the specialists of the Department of Agriculture, the main farms and dairy plants of the Vologda Oblast held in the period from 1990 to 2011 comprehensive studies on evaluating the quality and safety of raw milk produced in the region [2, 12].

Here are some of the research results based on the data of the Vologda Dairy Plant for 1999 – 2011 on all deliveries of milk out of sixteen basic farms.

The Vologda Dairy Plant is equipped with the most advanced technological and laboratory equipment. Production laboratory of the plant is a modern mobile mechanism, equipped with advanced instruments and means of operative control over the quality of raw milk and finished dairy products. This includes 7 express-control analyzers by the world-famous Danish company FOSS electric. In August 2011, another instrument produced by this company – Kjeltec – was introduced for the control of weight ratio of protein.

Analysis of this information enables us to draw a conclusion, that milk supplied by all farms is of the highest quality, and has high protein and fat content: 3.157 and 3.694% respectively in 2010; 3.216 and 3.716% in 2011.

Additionally, the dynamics of the quality of milk realized by these farms in 1999 – 2011 was studied.

Weight ratio of protein in milk for all the households increased in average from 3.106% in 1999 to 3.157% in 2010 and 3.216% in 2011; fat – from 3.649 to 3.694% and 3.716%, respectively.

In the same period, a clear tendency of increasing the quality of milk can be seen. So, the milk of the grade “extra” amounted to only 1.26% in 1999; the milk of 2 premium quality grades – VDP and “extra” – amounted to 22.65% in 2002, including VDP – 6.75%; and in 2011 – 86.2%, including VDP – 36.2%.

The given data demonstrate the target-oriented and efficient work of experts and heads of farms aimed at improving the quality of milk in accordance with strict present-day requirements. The effect and value of this work are especially noticeable on the background of significant milk yield increase during this period.

In the course of research on milk safety, scientists and practitioners have developed and are implementing measures aimed at improving its quality. In particular, permanent monitoring of the quality of milk sold to all the dairy plants of the region is carried out on a set of standardized indicators, including analyses of the content of contaminants. Measures, promoting the improvement of milk quality, included: preparing and distributing to all the farms of information on milk quality, its analysis and recommendations for elimination of deficiencies; training of more than 250 employees of dairy farms at the advanced training courses including the studies of new standards on milk and Technical regulations, training and certification of experts on the organoleptic estimation of milk, technological modernization of the more than 100 dairy farms, which are now equipped with new modern milking facilities; modernization of 125 milking machines with milk delivery lines; installation of more than 200 units of new refrigeration equipment on dairy farms; establishment of 125 dairy laboratories on the farms; organizing farm, district and regional competitions of milking machine operators, and for the last seven years – the district and regional contests of quality of raw milk “Best milk”.

Monitoring of veterinary and sanitary conditions of dairy farms, research on the presence of antibiotics and inhibitory substances are carried out; conformance of the quality and safety of raw milk with the requirements of technical regulations was organized. In the majority of farms, programmes of production control are developed and approved by the Heads, control over the observance of production technology, milk storage and transportation is systematically carried out.

As a result of these activities, the share of the first-grade product has increased from 73.8 to 88%, the share of off-grade milk has decreased from 2.5% to 0.3% over the period from 1990 to 2002. Since 1998, with the introduction of GOST 13264-88 and more

strict requirements for labeling milk as being of the “highest grade”, the quality of milk began to improve more rapidly. Over 2003 – 2007, the share of the highest grade milk (highest, euro, extra) has increased from 46.1 to 77.1%, in 2008 – up to 83%, and the share of off-grade milk decreased from 0.8 to 0.4%. For the year 2011, farms have sold 95.3% of raw milk of the highest and the first grade (for 2010 – 94.6%), including the premium quality milk – 50.5% (in 2010 – 24.6%).

In May 2011, the all-Russian contest of quality of butter-making and cheese-making products was held within the framework of the annual International week of butter- and cheese-making, which took place in the city of Uglich, the Yaroslavl oblast. The Vologda Oblast was represented by 12 milk processing enterprises. Most of the prizes were awarded to the products of Vologda enterprises (out of 25 samples of oil, 20 were awarded gold and silver medals). The jury pointed out the high quality of butter and cheese, made by Vologda specialists, and the Oblast received appraisal as one of the few Russian regions where natural products are produced in accordance with the traditional technologies.

However, the production volumes stated above, despite their exceptional importance from the point of view of meeting the needs of society in certain types of products, do not provide an answer to the question concerning the economic efficiency of production (*tab. 4*).

The analyzed period shows a tendency of increase in the gross and commodity production volumes. Reduction of return on assets is connected with the updating of the basic production assets. The analysis of financial situation showed that the current liquidity ratio and asset/equity ratio exceed normative values, therefore, the enterprises are solvent (*tab. 5*).

Quick assets ratio and asset coverage are below the normative ones, which indicates the insufficiency of highly liquid current assets of the enterprises and low supply of own working capital.

Table 4. Main indicators of economic activity at Vologodsky District enterprises

Indicators	2008	2009	2010	2011	2011 in % to 2008
Gross production of agricultural enterprises in comparable prices of 1994, thousand rub.	2659.7	2706.2	3050.5	3130.1	110
Goods in selling prices, thousand rub.	128139.5	142063.3	173186.2	197371	154.0
Average annual cost of BPA, thousand rub.	164838.1	150342.0	155128.8	176810.2	107.2
including in 2011 estimates	114205.6	145681.4	145128.8	176810.2	154.8
Basic production assets in agriculture, thousand rub.	142377.9	117194.6	148658.4	166114.1	116.7
including in 2010 estimates	98644.4	113561.6	128658.4	166114.1	168.4
Labor productivity, rub./pers.	20.8	21.4	22.1	24.6	118.2
Capital-labor ratio, thousand. rub./pers..	0.72	0.73	0.78	0.99	137.5
Capital-labor ratio per 100 ha of agricultural land, thousand rub.	1.50	1.71	1.94	2.1	140
Yield of capital investments, rub. per 100 rub.	2.9	2.3	2.4	2.5	86.2
Profitability (loss ratio), %:					
General, including	11.9	7.5	7.3	5.1	×
milk	30.5	21.2	19.0	19.0	×
cattle meat	-23.0	-28.0	-29.0	-27.0	×

Table 5. Main indicators of financial condition of enterprises of Vologodsky District

Indicators	Standard	Year		
		2009	2010	2011
Ratios:				
– current liquidity ratio(coverage)	≥ 1.5 – 2.0	2.92	4.13	3.10
– quick assets ratio	0.7 – 0.8	0.38	0.47	0.53
– asset coverage	≥ 0.1	-0.01	-0.01	-0.13
– asset/equity ratio (financial leverage)	0.5-1.0	0.49	0.61	0.53

Table 6. Evaluation of financial stability of Vologodsky District enterprises

Indicators	Standard	Year		
		2009	2010	2011
Ratios:				
– equity ratio	≥ 0.5	0.49	0.61	0.53
– leverage ratio	≥ 0.5	1.57	1.64	1.89
– current assets to equity ratio	0.2 – 0.5	-0.21	-0.19	-0.67
– debt to equity ratio	≥ 1	1.17	1.25	2.35

In general, one can point out a relative financial stability of Vologodsky District enterprises, as well as their wide-scale attraction of borrowed funds for maintaining their sustainable activity (*tab. 6*).

According to forecast estimates, the volume of agricultural production in 2020 will exceed the 2009 level by almost 40%. To achieve the set tasks, it is necessary to develop the following directions of the Oblast's agro-industrial complex:

1. The raise of products' competitiveness on the basis of financial stability and modernization of production facilities, the accelerated development of priority sub-sectors and production facilities, quality improvement.

2. The increase of competitiveness of agricultural products in the Oblast consists in reducing their production costs and establishing the prices depending on the products' quality and consumer demand.

For implementing these activities, it is planned to set conditions for attracting investments into production facilities modernization, the rapid development of priority sub-sectors and state support of these activities.

Thus, the development of the Vologda Oblast's agroindustrial complex according to the target scenario will allow to avoid market and administrative risks, to receive significant positive social, economic and environmental benefits in future.

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