Ways of Increasing the Efficiency of Sheep Breeding in the Russian Federation

T E Marinchenko*

1Russian Research Institute of Information and Feasibility Study on Engineering Support of Agribusiness, the Federal State Budgetary Scientific Institution (Rosinformagrotekh FSBSI), 60, Lesnaya Str., Pravdinsky Township, 141261 Moscow Region, the Russian Federation

*E-mail: 9419428@mail.ru

Abstract. The sheep breeding industry in Russia remains one of the most extensive among other livestock industries. The main task of the industry is to intensify production through selection work and the introduction of up-to-date equipment and technologies. Therefore, the assessment of sufficiency and the development of proposals for improving engineering and process infrastructure and the main ways of scientific research in the field of sheep breeding in order to achieve the tasks set for the industry by the government is relevant. At the same time, digitalization processes in animal husbandry are underway, which can become a good basis for modernization in the industry. Farmers and households remain the main producers of wool and meat. There is a positive experience of introducing new processes for keeping and feeding them in their production and subsequent production of better quality products.

1. Introduction

Sheep breeding plays a key role in the development of the agribusiness of the country and rural areas of mountainous and steppe regions, which feature a low level of soil fertility, a shortage of land suitable for agricultural production and scarce pastures. Over the years, the development of the industry has taken place under the conditions of the traditional technology of pasture keeping, which has been part of the lifestyle of the population and still provides employment for the rural population in many regions.

The main livestock is concentrated in personal subsidiary plots (42.8%), peasant (farm) enterprises and individual entrepreneurs (40.7%), the number of sheep in agricultural organizations from their total number is only 16.5% (table 1) [1, 2].

Table 1. Structure of production of sheep and goats for slaughter in live weight, thousand metric tons.

| Years       | Farms of all categories | Agricultural organizations | Farms of the populations |
|-------------|-------------------------|---------------------------|-------------------------|
|             | 2015  | 2016  | 2017  | 2018  | 2019  | 2020  | 2020 to 2015 | 2020 to 2019 |
| 2015        | 454.2 | 465.8 | 475.1 | 482.9 | 465.1 | 460.3 | 101.3        | 99           |
| 2016        | 34.8  | 34.8  | 33.2  | 37.3  | 35    | 35.9  | 102.7        | 102.6        |
| 2017        | 324.8 | 331.3 | 333   | 334.3 | 38.1  | 306.8 | 94.4         | 96.4         |
| 2018        |       |       |       |       |       |       |              |              |
| 2019        |       |       |       |       |       |       |              |              |
| 2020        |       |       |       |       |       |       |              |              |

Content from this work may be used under the terms of the Creative Commons Attribution 3.0 licence. Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI.
Peasant (farm) enterprises, including individual entrepreneurs  

|                | 94.4 | 99.8 | 108.8 | 111.3 | 112 | 117.6 | 124.5 | 104.9 |

Therefore, the basic producers of meat and wool remain personal subsidiary plots and peasant (farm) enterprises along with individual entrepreneurs, whose total share accounts for 92.3% of sheep and goat meat in slaughter weight and 84.9% of wool in physical weight (table 1) [1]. The production in this type of farms is, as a rule, extensive. The resulting wool is of low quality. Most of the Personal subsidiary plots and peasant (farm) enterprises keep coarse-wool and cross-breed sheep intended mainly for the production of mutton meat and having low quality wool. The gain is also small, since the livestock is fed on natural and scarce pastures [3].

At the present stage, the main task of the industry is the intensification of production, which, against the background of an increase in animal productivity through effective breeding work, is ensured by the introduction of advanced processes and up-to-date equipment in industrial production.

The elements of industrial production are stall keeping; feeding with compound feeds or complete feed mixtures; compacted reproduction (including hormonal synchronization of cycles, artificial insemination, early weaning and artificial feeding of young animals); intensive feeding of young animals for meat; automated milking in the dairy farms.

At the present stage, increasing production efficiency is based on the introduction of innovative technologies and modern equipment, which are the result of research and development.

2. Materials and Methods

The subject of the study was the sheep breeding industry, the purpose of the work was to assess the engineering and process infrastructure, the main areas of scientific research from the standpoint of their aggregate sufficiency to achieve the tasks set for the industry by the government, as well as the development of proposals for improvement of these areas. The informational basis of the study was the official data obtained from the Russian Federal State Statistics Service, the Ministry of Agriculture of Russia, industry unions, materials of research institutions, the papers of leading scientists in the field of research, as well as legislative acts that establish strategic guidelines for the development of the country and the industry were used. The research was based on a general scientific methodology using methods of monographic, comparative, factorial and logical analysis, as well as an expert-analytical method for processing initial information.

3. Results and Discussion

Scientific research in the interests of sheep breeding is performed in 15 research institutes and 5 educational organizations. In the last decade, thirteen breeds and twelve breed types that feature high productivity have been created. A system of genetic monitoring based on immunogenetic methods has been created. The methods of genomic selection are being developed [4].

Based on the Texel sheep meat breed, the Tashlinskaya meat and southern meat breeds have been created using Australian meat merino rams. The Russian meat merino has been created in fine-wool sheep breeding. A new meat-fur type of sheep has been created based on meat-wool sheep of the Romney Marsh type and Romanov breed sheep with increased viability and improved meat qualities along with the preservation of high fertility, polyestricity and high fur coat qualities inherent in sheep of the Romanov breed. Based on Volgograd sheep and Suffolk beef rams, work is underway to create a meat type with increased early maturity and meat qualities [5, 6].

Work is being carried out in the country both to develop new machines and to improve individual units. However, all this work is limited to the creation of prototypes and currently there are no enterprises that produce special process equipment for sheep on an industrial basis.

As in the rest of the world, sheep breeding in the Russian Federation remains one of the most extensive industries. At the same time, the basic production processes, for example, in sheep breeding, should have a 25 to 100% level of mechanization in accordance with the RD-APK 1.10.03.02-12
guidelines, which are included in the system of agribusiness recommendation documents of the Ministry of Agriculture of Russia, (table 2) [7].

Table 2. The level of mechanization of the basic production processes in sheep breeding.

| Basic production processes                             | Mechanization level, % |
|--------------------------------------------------------|------------------------|
| Mechanization:                                         |                        |
| – water consumption (watering)                         | 80                     |
| – feed distribution                                    | 25                     |
| – manure removal                                       | 30                     |
| – shearing                                             | 90                     |
| – milking                                              | 50                     |
| Automation:                                            |                        |
| – infrared and ultraviolet irradiation of lambs        | 100                    |
| – heating water for drinking animals                   | 100                    |

Currently, the country does not develop equipment for the implementation of the basic production processes on sheep-breeding dairy farms, in particular, milking equipment. Mainly milking parlors of European and American manufacturers (such as carousel or parallel ones), as well as mobile milking machines of various foreign manufacturers are available in the Russian market [8].

Taking into account the challenges set by the government for sheep breeding, the task of developing and organizing the production of dedicated equipment for sheep breeding at domestic enterprises, such as equipment for keeping sheep (including feeders and shields), for watering at the farms and on pastures (watering along with heating provides additional weight gain up to 3 kg per head), means for drying and local heating of newborn lambs, systems for milk feeding lambs aged from 1-2 up to 45-60 days using milk replacer based on plant raw materials (with 40% artificial rearing of lambs of the Romanov breed, it is possible to get three lambing in two years), equipment for milking and processing milk and feeding at farms, technical means for enclosure pasturing using UAVs, electric shearing units (including sharpening devices), wool presses, installations for bathing sheep, etc. The implementation of engineering projects for the production of sheep products will contribute to an increase in labor productivity by at least 20-25% while obtaining additional weight gain and shearing of wool due to improving the conditions for keeping animals, to more rational use of feed in the form of feed mixtures, to increasing the safety of young stock by 10-15%, to improving working conditions of sheep breeders, and to rational use of pastures [9, 10].

The demand for young lamb in the consumer market and the ability to obtain it from fine-fleeced sheep breeds with a sufficient supply of fodder increases the relevance of the development of intensive technologies for the young mutton sector. Analysis of the state of the world sheep breeding indicates that, in the conditions of intensive farming, the transition of the industry to obtaining meat products of sheep breeding is promising.

The sector of meat sheep breeding is just beginning to form in Russia. One of the main factors that does not contribute to the intensification of the meat area in Russian sheep breeding is the predominantly grazing practice of fattening due to the relatively high availability of natural pastures that do not require special cultivation, as well as the unwillingness of most farmers to switch to new technologies that require capital investments in farms. At the same time, many countries successfully use a combination of grazing and stall feeding based on contract rearing of lambs at the first stage and supplementary feeding of sheep for slaughter in feedlot by industrial companies that have their own slaughtering and processing facilities at the second stage [9].

Current large-scale production of lamb is based on a stall system, where feeding is organized that ensures an intensive weight gain with a daily gain of 300 grams of the hybrid lambs. At the
age of four months, animals can already be sent for slaughter and obtain a marketable carcass weighing 20 kg.

To increase the production of mutton, a number of regions of Russia perform research and production work to improve the existing and create new early ripening meat and meat-wool breeds and types of sheep, such as using industrial crossing; increasing the level of breeding work through the introduction of biotechnology and computerization; strengthening the forage base by improving natural forage lands and expanding field forage production. To increase the meat productivity of sheep, pasture feeding with supplementary feeding and stall fattening of sheep using green fodder, silage, haylage, and mixed fodders are widely used.

Damate Group has brought in a batch of purebred experimental animals that are breeders and ewes of foreign selection from the leading breeders of Holland and Great Britain. These breeds are Charolais, Poll Dorset, Ile de France, Swifter, Texel, Zwartbles and Blue-faced Leister. The first hybridization experiments have shown good results: most of the sheep bore twins, and some even triplets, the average weight of newborn lambs is 4-5 kg, and the average daily weight gain reaches 400 g [11].

One of the ways to improve efficiency in the industry is to use the potential of peasant (farm) enterprises and personal subsidiary plots while making it easier for them to access high quality genetic material. To displace unproductive local livestock, one can use preferential purchase of livestock (and semen) of high-quality breeding material, its leasing, rent of stud rams, etc. It is necessary to use artificial ewe insemination using seed from improvers, programs for absorptive crossing, etc. within the framework of regional programs. Just large producers having good genetics can help it.

Damate Group has a positive experience in attracting small businesses. At the end of 2020, Damate Group performed the first massive artificial insemination of sheep at the farms of the Stavropol and Krasnodar Territories in the livestock of over 5,000 heads of sheep. The services of Damate Group were used by twelve peasant (farm) enterprises and two agricultural enterprises, which entered into contracts with a service company. Farmers were given the opportunity to transfer young animals for fattening to the Damate Group feedlot designed for a one-time maintenance of 14,000 heads or about 50,000 animals annually or independently hand them over to a meat processing enterprise [9, 11].

Thus, there is every reason to predict a steady growth in the annual production of Russian mutton (for domestic consumption and export) by at least 200-250%, i.e. this will be an increase in current amount from 200,000 to 600,000 metric tons in carcass weight by 2035.

According to federal legislation, all companies involved in the circulation of goods of animal origin were required to switch to electronic veterinary certification through the Mercury federal state information system (FSIS) from 2018. The turnover of controlled goods includes their production, processing, storage, transportation and sale. Lamb is also included in the list of controlled goods.

In the near future, the introduction of an electronic registration system for animals with registration of detailed data on their origin, place of keeping, diseases and vaccinations will begin. Chipping will be subject to 100% of breeding and fattening animals, which will allow integrating their data into the system of from farm to counter traceability of livestock products.

The combination of systems for electronic certification of livestock products and animal identification will inevitably lead to the fact that in the next two to three years, unscrupulous suppliers of sheep for slaughter, clandestine processors and transporters of mutton, as well as traders using falsified documents, will be squeezed out of the market by officially registered companies with electronically certified livestock and products. In addition, producers of sheep and lamb will not be able to export their products without mandatory state registration of sheep and electronic veterinary certification in Mercury and other components of the VetIS system of the Federal Service for Veterinary and Phytosanitary Supervision (Vesta, Argus, Cerberus, Cyrano, etc.). As a result, there will be a natural restructuring of the industry in favor of industrial producers with vertically integrated
breeding facilities and own or contract herds of sheep for fattening, slaughter, processing, logistics and sales [12, 13].

4. Conclusion
The sheep breeding industry has been challenged with increasing the production of sheep breeding products and improving their quality, which will contribute to ensuring the food security of the Russian Federation and fulfilling the tasks of developing export potential.

At the present stage, the main producers of sheep products are personal subsidiary plots, peasant (farm) enterprises and individual entrepreneurs, who pay little attention to selection and breeding work, the introduction of modern technologies and techniques. These farms feature low animal productivity and low quality wool, while the market is in demand for high quality products. Therefore, it is advisable, when developing regional support measures, to provide support measures that stimulate selection and breeding work and the introduction of innovations.

It is necessary to use the potential of peasant (farm) enterprises and personal subsidiary plots while facilitating their access to high-quality genetic material, which large producers have, and to involve scientific organizations for scientific support and consultations. Damate Group has a positive experience of attracting small businesses in the production of high quality products, which contributes to the growth of production efficiency of the latter.

At the same time, there are processes of intellectualization of animal husbandry, which is based on the identification of animals. This will be facilitated by the introduced system of electronic registration of animals with registration of detailed data on their origin, place of keeping, diseases and vaccinations. Chipping will be subject to 100% of breeding and fattening animals, which will allow integrating their data into the system of from farm to counter traceability of livestock products. The implementation of identification must be used with the maximum efficiency that the herd management toolkit can provide, and the investment in this process to maximize the modernization of production must be used too.

The combination of electronic certification systems for livestock products and animal identification will inevitably lead to the fact that in the next two to three years, unscrupulous suppliers of sheep for slaughter, clandestine processors and transporters of lamb, as well as traders using falsified documents, will be removed from the market by officially registered companies with electronically certified livestock and products. In addition, producers of sheep and lamb will not be able to export their products without mandatory state registration of sheep and electronic veterinary certification in Mercury and other components of the VetIS system of the Federal Service for Veterinary and Phytosanitary Supervision, which will further strengthen the positions of conscientious suppliers. As a result, there will be a natural restructuring of the industry in favor of industrial producers having vertically integrated breeding facilities, own or contract herds of sheep for fattening, slaughter, processing, logistics and sales. It is advisable to combine this with the maximum automation of production, which will increase labor productivity.

Large producers of sheep and goat breeding products have appeared in the industry, not only actively using modern technologies, but also implementing their own scientific and technological projects, for example, Damate Group and Miratorg. Others are involved in scientific research of scientific institutions. Their experience should be studied and widely use.

References
[1] National report on the progress and results of the implementation in 2020 of the State program for the development of agriculture and regulation of markets for agricultural products, raw materials and food Retrieved from https://mcx.gov.ru/upload/iblock/953/953ee7405fb0eab38a6031a13ce0021.pdf (accessed on 08/25/2021)
[2] Erokhin A I and Karasev E A 2019 State, dynamics and development trends of sheep breeding in the world and in Russia Sheep, goats, wool business 3 3-7
[3] Kuznetsova N A, Ilyina A V, Mironov M, Korolkova A P and Marinchenko T E 2021 Small business environment and development problems in the Russian Federation E3S Web of Conferences 244 10043

[4] Marinchenko T 2021 Scientific support for the innovative development of sheep breeding in the Russian Federation E3S Web of Conferences 254 8013

[5] Gorlov I F, Slozhenkina M I, Shakhbazova O P, Radzhabov R G, Ivanova N V, Anisimova E Yu and Knyazhechenko O A 2020 Meat productivity and interior features of the different genotypes of the rams Edilbaev breed IOP Conf. Ser.: Earth Environ. Sci. 548 082083

[6] Khamiruev T, Bazaron B, Chernykh V, Volkov I and Dabaev O 2018 Selection achievement in demi-coarse wool sheep breeding in Russia Russian Agricultural Sciences 44 350-353

[7] Fedorenko V 2012 RD-APK 1.10.03.02-12 Guidelines for Process Design of Sheep-Breeding Facilities (Moscow: Rosinformagrotekh)

[8] Yuldashbaev Yu A, Morozov N M, Kolosov Yu A, Kuzmin V N, Kuzmina T N and Svinarev I Yu 2020 Innovative Technologies for Keeping Small Ruminants (Moscow: Rosinformagrotekh)

[9] Traisov B B, Smagulov D B, Yuldashbaev Y A, Esengaliev K G 2017 Meat productivity of crossbred rams after fattening Journal of Pharmaceutical Sciences and Research vol 9 5 574-577

[10] Yuldashbayev Yu A, Shevhuzev A F, Kochkarov R Kh, Mishvelov E G and Ponomareva A I 2018 Meat productivity of young sheep karachai' breed Research Journal of Pharmaceutical, Biological and Chemical Sciences 9 4 692-699

[11] Surov A I and Serdyukov V N Current state and prospects for the development of beef sheep breeding in the Russian Federation Retrieved from http://www.rnso.net/index.php?option=com_content&task=view&id=8 (accessed on 05/11/2021)

[12] Marinchenko T E 2020 Digitalization as a driver of development of domestic animal breeding IOP Conference Series: Materials Science and Engineering 012004

[13] Turgenbaev M S and Rusakov A N 2018 Promising mechanized technologies and technical means for the sheep breeding products Bulletin of VNIIM 3(31) 123-127