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Пути повышения продуктивных качеств крупного рогатого скота и перспективы развития специализированного мясного скотоводства в Воронежской области

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В ходе исследования определена динамика численности поголовья основных видов сельскохозяйственных животных на территории Воронежской области за последние 108 лет (1916–2023). Обнаружена тенденция к сокращению общей численности поголовья крупного рогатого скота, в том числе коров, вплоть до 2010 г., что стало причиной ввоза иностранных пород. Данные показали, что многие хозяйства в России, занимающиеся молочным скотоводством, начали параллельно развивать специализированное мясное скотоводство в условиях стойловой системы содержания с использованием старых реконструированных коровников. Изучены показатели мясной продуктивности лимузинской породы крупного рогатого скота при стойловом содержании в условиях Воронежской области. Согласно результатам исследования, бычки во все технологические периоды превосходили телочек по живой массе и, соответственно, по показателям среднесуточного и валового прироста. Среднесуточный прирост у бычков за 570 дней выращивания, доращивания и откорма составил 1039,8 г, что на 606,0 г больше, чем у телочек. При убое бычков получены тяжеловесные туши. Дополнительный откорм бычков в течение месяца позволил повысить их живую массу на 24,7 кг, убойную – на 23,5 кг, убойный выход – на 1,2%. Туши бычков характеризовались небольшим содержанием внутреннего жира (2,5–3,7 кг). Все туши имели высокие оценочные характеристики и соответствовали классу А, категории «Супер». Согласно расчету экономической эффективности, производство говядины от бычков лимузинской породы в условиях стойловой системы содержания позволяет поддерживать рентабельность производства на уровне 26,1%.

Ключевые слова: крупный рогатый скот, лимузинская порода, мясное скотоводство, говядина, мясная продуктивность, стойловая система содержания

Ways to improve productive qualities of cattle and prospects for the development of specialized beef cattle breeding in the Voronezh region

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In the course of the study, the dynamics of the number of the main types of farm animals on the territory of the Voronezh region for the last 108 years was determined (1916–2023). A tendency to decrease the total number of cattle including cows up to 2010 was detected, which was the reason for the importation of foreign breeds. The data showed that many dairy farms in Russia started to develop specialized beef cattle breeding in parallel under the conditions of the stall system using old reconstructed barns. The indicators of meat productivity of the Limousin breed of cattle under stall keeping in the conditions of the Voronezh region have been studied. According to the results of the study, steers in all technological periods were superior to heifers in live weight and, accordingly, in terms of

average daily and gross gain. The average daily gain in steers for 570 days of growing, rearing and fattening amounted to 1039.8 g, which is 606.0 g more than in heifers. Heavy carcasses were obtained when slaughtering steers. Additional fattening of steers during a month allowed to increase their live weight by 24.7 kg, slaughter weight increased by 23.5 kg and slaughter yield by 1.2%. Carcasses of steers were characterized by low internal fat content (2.5–3.7 kg). All carcasses had high evaluation characteristics and corresponded to class A, the "Super" category. According to the calculation of economic efficiency, beef production from the Limousin steers under the conditions of stall housing system allows to maintain the profitability of production at the level of 26.1%.

Keywords: cattle, Limousin breed, beef cattle farming, beef, meat productivity, stall housing system

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Конфликт интересов

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Conflict of interest

The authors declare no conflict of interest.

INTRODUCTION

The production of agricultural products to provide the population with high-quality protein is the main task of the country's agro-industrial complex. In its development, livestock farming has changed several forms of production: for example, there was a transition from extensive to intensive technologies, which allows increasing production indicators while reducing production costs. These changes could not but affect the number of livestock population of all types of livestock [1, 2].

One of the most problematic areas of meat production is beef production. In order to solve the problem of reduction in the number of cattle, as well as to increase the level of productive output during ten years since 2005, more than 55 thousand cattle were imported to the region, half of which are represented by beef cattle. Animals were brought from 12 countries, including the USA, Germany, Australia, France, Hungary. In total 11 different breeds of cattle were imported¹.

Voronezh region is one of the key regions of the country for cattle breeding with favorable natural and climatic conditions. Among meat

breeds in the farms of Voronezh region the main mass are Aberdeen-Angus, Kazakh white-headed, Simmental meat type, Blanc Bleu Belge (Belgian Blue) and Limousin breeds. At the same time, the number of Aberdeen-Angus breed livestock in 2019 amounted to 90.0%, the others accounted for 5.0; 2.0; 2.0 and 1.0%, respectively. Of the animals of the listed breeds, 96.4% were purebred for four generations, more than half belonged to the elite-record class (51,8%) [1].

Important factors in cattle breeding are housing conditions and balanced nutrition. There are several cow housing systems, including different combinations of indoor and outdoor housing. However, all of them are aimed at increasing productive yield and reducing total costs. The same goals are pursued by farms when selecting feed for cattle. This can cause deficiencies in certain elements, lead to the development of non-communicable diseases and reduce reproductive performance. Elemental deficiency in cattle can be diagnosed by various methods including evaluation of blood parameters, hair composition, urine, etc. [3]. Often in individuals with micronutrient deficiency, one can find a violation of the antioxidant defense system

¹Ryabova E.P. Potential for the development of cattle breeding in the Voronezh region: Candidate's thesis in economic sciences, Voronezh, 2019, 176 p.

with the formation of oxidative stress, changes in the morphology of organs and tissues, delayed development, changes in the enzyme system, which negatively affects the overall condition of their body [4, 5]. Even with a balanced diet, many studies show an improvement in the main indicators of animals with the introduction of food additives containing trace elements, for example Fe, Se, I и т.д.^{2, 3} [6].

To stimulate the development of the agricultural sector, the state periodically allocates various amounts in the form of grants. This helps new entrepreneurs to enter this sphere of food industry as suppliers, and also organizes new jobs. The Voronezh region has a significant reserve of fodder lands for breeding specialized meat breeds of cattle, which serves as one of the factors of livestock breeding development⁴ [7].

At the moment it is possible to breed specialized breeds of cattle under the conditions of the stall system of keeping using old barns that have undergone a small reconstruction and the construction of new lightweight buildings and fattening grounds. At the same time in the region there is a significant array of natural pastures, which can provide animals with the necessary amount of plant food. The use of specialized meat breeds in the conditions of Voronezh region is one of the main ways to increase beef production [8].

Many studies also prove positive tendencies of growth of the main physiological indicators of the animal organism when using various artificial and organic additives. Supplements based on soy protein, various vegetables and fruits, containing mineral complexes, as well as mono-preparations of individual minerals or vitamins can serve as an example. These help to improve milk quality, enhance muscle growth, reduce disease and strengthen immunity [5, 9].

The objectives of the study are to assess changes in the number of farm animals of the main species and to study the peculiarities of formation of indicators of meat productivity of the Limousin breed of cattle under conditions of stall housing.

Objectives of the study are to:

- 1) analyze data on the dynamics of the number of farm animals for the maximum possible period of time;
- 2) study indicators of meat productivity of specialized beef Limousin breed of cattle under conditions of stall housing on separate technological periods;
- 3) evaluate the main slaughter parameters of Limousin steers at 19- and 20-months of age;
- 4) calculate the profitability of beef production from Limousin steers under the conditions of stall housing system.

MATERIAL AND METHODS

As sources of information on the number of farm animals, data from various farms, studies by other scientists and statistical compilations were used.

The study of various productivity indicators of specialized Limousin meat breed under the conditions of stall housing system was carried out on the animals of the farm OOO "Bolshevik" (Voronezh region). Animals were brought to the farm in 2011, and at the moment more than 95% of the increased herd belong to the elite-record class. Two experimental groups of 20 animals each were formed to analyze the features of formation of the Limousin breed meat productivity. The first group is represented by steers and the second by heifers. Growth of experimental stock was evaluated during the maximum possible time (19 months) for separate technological periods to get the most complete

²Chertkov V.P., Boyarina E.D., Ventsova I.Yu. Metabolic pathways of trace elements in the body of animals // Youth vector of development of agrarian science: materials of the 74th National scientific and practical conference of students and master's students (Voronezh, April 1 - May 31, 2023), Voronezh, 2023, pp. 367–370.

³Karpenko L.Yu., Bakhta A.A., Ivanova K.P. Study of the effect of selenium-containing preparation on the biochemical status of cows // Actual problems of agrarian science: applied and research aspects: a collection of scientific articles All-Russian (national) scientific-practical conference (Nalchik, February 4–5, 2021). Nalchik, 2021, vol. 2, pp. 189–191.

⁴Malakhova D.V., Nedikova E.V. State support of small-scale farming (on the example of the Voronezh region) // Actual problems of land management, cadastre and environmental management: proceedings of the scientific conference Voronezh, 2020, pp. 386–392.

picture. According to the results of growing steers, control slaughter of three animals at the age of 19 months and mass slaughter at the age of 20 months were carried out. The carcasses of Limousin bulls, kept under the conditions of the stall system, were evaluated according to the requirements of GOST 34120–2017⁵.

RESULTS AND DISCUSSION

The analysis of the number of farm animals of the main species in the farms of the Voronezh region showed significant changes in the number of animals depending on the year. Table 1 presents data for 108 years. The Central Black Earth zone of Russia as a whole and the Voronezh region in particular have traditionally specialized in the breeding of cattle, which is eloquently evidenced by the dynamics of the number of farm animals for this period.

The maximum number of cattle in all categories of the farms was recorded in 1987 – 1525.9 thousand cattle, including 546.7 thousand cows. In the mentioned period the main breed of cattle in the Voronezh region was the Simmental breed

characterized by high indicators of meat productivity. Since 1985 intensive work on creation of domestic specialized breed of cattle on the basis of crossing the breeding stock of the Simmental breed with Red-and-White Holstein bulls began in the region. This work along with a significant increase in the level of milk productivity of mongrel cattle led to a certain decrease in meat qualities.

However, since the early 1990s, there has been a significant decline in the number of all types of animals. The trend of decline in the total number of cattle populations was observed until 2010. In this period there were 358.2 thousand heads of cattle, of which cows accounted for 145.6 thousand heads. In agricultural organizations the number of cows decreased from 436.0 thousand to 74.3 thousand heads, i.e. almost 6 times [10]. All this had a negative impact on the production not only of milk, but also of beef. Although the number of cattle, including cows, has slightly increased over the last 13 years, the growth of the indicator is still unstable and insignificant. As of 2023, the total number of cows

Табл. 1. Численность сельскохозяйственных животных основных видов в хозяйствах Воронежской области, тыс. гол.

Table 1. Number of farm animals of the main species in the farms of the Voronezh region, thousand heads

Year	Farms of all categories				Agricultural enterprises			
	Cattle	Including cows	Pigs	Sheep and goats	Cattle	Including cows	Pigs	Sheep and goats
1916	643	288	251	1214	–	–	–	–
1935	584	275	308	444	–	–	–	–
1941	633	304	357	1153	298	51	238	521
1946	667	305	135	656	235	32	95	217
1950	778	320	327	873	380	67	293	470
1965	1115	517	1322	1156	798	310	1030	663
1976	1477,6	580	1317	1457,6	1248,5	426	1165,9	1079,0
1987	1525,9	546,7	1763,5	1414,0	1356,3	436	1678	1114,5
1995	1069,4	481,1	823,1	607,8	866,8	354,3	635,5	312,1
2000	673,4	324,5	563	221,2	510,2	218,7	3495	65,3
2010	358,2	145,6	479,0	116,3	199,4	74,3	230,8	20,5
2015	451,1	180,0	664,7	230,9	281,2	111,4	621,6	26,8
2021	505,5	176,8	1835,7	192,0	363,9	128,2	1814,4	15,5
2023	489,0	171,7	1966,1	176,8	357,4	126,8	1948,8	14,0

⁵GOST 34120-2017. Cattle for slaughter. Beef and veal in carcasses, half carcasses and quarters. Technical conditions. Moscow: Standardinform, 2020, 20 p.

in agricultural organizations amounted to 126.8 thousand cows, of which the share of dairy cows accounted for 100.7 thousand cows, beef cows – 27.5 thousand cows. According to the results of economic activity of agricultural enterprises of the Voronezh region in 2023, 588.41 thousand tons of main types of livestock and poultry were produced for slaughter in live weight, and only 67.61 thousand tons (11.5%) of them accounted for the share of cattle. In the best years this indicator exceeded 40% [11, 12].

Over the last 50 years, the pastures, which used to be occupied by sheep and goats, have been practically freed - their number decreased from 1457.6 thousand to 176 thousand heads (8 times) over the period from 1976 to 2023^{6,7}. This may serve as an additional incentive for the development of cattle breeding in the Voronezh region. An example of effective production of high-quality dietary meat can be OOO “Bolshevik” of the Khokholsky district and OOO “Farm ‘Novomarkovskoye’” of the Kantemirovsky district.

Studies on breeding of specialized meat Limousin breed in conditions of stall system of keeping in OOO “Bolshevik” testify that experimental bulls in all technological periods surpassed heifers in live weight, average daily and gross gain (see Table 2).

Changes in the dynamics of live weight of experimental animals by separate technological periods show that the average daily gain during suckling period in the first and second groups differed by 63.2 g, during growing – by 425.9 g, fattening – by 447.6 g. During the whole period of live weight gain in bulls amounted to 1039,8 g, which is 606,0 g more than in heifers. During the whole period of weight gain, the average live weight of steers reached 619.2 kg, while the average weight of heifers was only 459.0 kg, which clearly indicates the sexual dimorphism between

animals and shows the efficiency of growing steers as over-repair young stock. Similar results were obtained in the comparative analysis of meat productivity of bulls and heifers of Blanc Bleu Belge breed⁸.

During the study, control slaughter of three steers at the age of 19 months and mass slaughter of steers at the age of 20 months were carried out. Slaughter indices of experimental steers are presented in Table 3. Data analysis allows us to conclude that heavy carcasses were obtained as a result of slaughtering of steers. Removable live weight of animals in both cases exceeded 600 kg, and additional fattening of steers during a month allowed to increase pre-slaughter live weight by 24.7 kg, slaughter weight – by 23.5 kg, slaughter yield – by 1.2%. Slaughter weight of steers at 19 months of age was 385.4 kg with slaughter yield of 62.0%, while by 20 months of age slaughter weight reached an average of 408.9 kg, slaughter yield increased by 1.2%.

Carcasses of steers were characterized by a small content of internal fat (2.5– 3.7 kg), had high evaluation characteristics, corresponded to class A and category “Super”⁹.

Calculation of economic efficiency has shown that beef production from Limousin bulls under the conditions of stall housing system allows to maintain the profitability of production at the level of 26,1%.

CONCLUSION

Examination of data on the main farm animals allowed assessing the change in their numbers over time, which ultimately illustrates the need to develop this area of agriculture.

Limousin bulls are an example of cow breed with high meat productivity. The obtained data show that heifers' performance is inferior to that of the bulls. So, the live weight of heifers by

⁶Artemov E.S., Khromova L.G., Larin O.V., Vlasova I.V. Breeding base of cattle meat direction of productivity of the Voronezh region // Theory and practice of innovative technologies in agroindustrial complex: proceedings of the national scientific and practical conference, Voronezh, 2022, part 8, pp. 35–39.

⁷Agriculture in Russia: statistical digest / Federal State Statistics Service (Rosstat). Moscow, 2019, 2021, 2023.

⁸Pegusov A.S. Development of cattle breed Blanc-Bleu Belge in the Voronezh region // Veterinary and sanitary aspects of quality and safety of agricultural products: materials of the 5th Intern. scientific-practical conf., Voronezh, 2021, part 2, pp. 262–264.

⁹Savrasova N.P., Semenov S.N. Integrated veterinary and sanitary evaluation of meat raw materials // Veterinary and sanitary aspects of quality and safety of agricultural products: proceedings of the VI Intern. scientific-practical conf., Voronezh, 2022, pp. 248–250.

Табл. 2. Изменение показателей мясной продуктивности бычков и телочек лимузинской породы по основным технологическим периодам

Table 2. Change in meat productivity of the Limousin breed steers and heifers by main technological periods

Indicator	Calf bulls			Heifers		
	Suckling	Completion of growing	Fattening	Suckling	Completion of growing	Fattening
Period duration, days	240	180	150	240	180	150
Live weight, kg: at the beginning of the period	26,50 ± 0,64	263,50 ± 3,24	464,90 ± 8,10	25,20 ± 0,68	241,10 ± 2,51	371,80 ± 2,45
at the end of the period	263,50 ± 3,24	464,90 ± 8,40	619,20 ± 8,90	247,10 ± 2,51	371,80 ± 2,45	459,00 ± 2,18
Live weight gain for the whole period, kg	237,00 ± 3,36	201,30 ± 8,32	154,30 ± 6,93	221,90 ± 2,45	124,70 ± 2,55	87,10 ± 1,93
Average daily gain, g	987,70 ± 14,00	1118,60 ± 46,20	1028,60 ± 46,18	924,50 ± 10,21	692,70 ± 14,15	581,00 ± 1286

Табл. 3. Убойные показатели подопытных бычков

Table 3. Slaughter performance of experimental bulls

Indicator	Slaughter age	
	19 months	20 months
Number of animals, heads	3	19
Market live weight, kg	648,0 ± 9,8	688,7 ± 10,9
Preslaughter live weight, kg	621,3 ± 11,5	646,0 ± 9,9
Slaughter weight, kg	385,4 ± 13,5	408,9 ± 21,5
Slaughter yield, %	62,0 ± 1,1	63,2 ± 2,8

150th day of fattening averaged 459,0 kg, the live weight of bulls for the same period reached 619,2 kg. The evaluation of slaughter indexes of animals of this breed showed that by 20 months of age, the removable live weight of bulls amounted to 688.7 kg, which is 40.7 kg more than that of 19-month-old bulls. Slaughter yield by 20 months of age was 63.2%, slaughter weight was 408.9 kg. Profitability of production under the conditions of the stable system of housing amounted to 26,1%.

Thus, the use of cattle of specialized beef Limousin breed in the conditions of the stable system of keeping in the conditions of the Central Black Earth zone of Russia allows carrying out profitable production of high-quality beef.

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