

Research Article**The Influence of Line Accessory of Bulls on Meat Quality****¹Kibkalo L. I., ²Kravtsova T. E., ³Kolesnikov A. V.,****⁴Gudymenko V. I., ⁵Bugaev S. P., ⁶Lyashuk R. N.****and ⁷Sein O. B.,**

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ABSTRACT.

The article examines the impact of line accessory of Holstein breeds bull-calves of Black-Pied colour on quality parameters of meat. For experience three groups of animals of 12 heads each were formed. In the first group – the bulls of the Sunnyside Standout twin line, in the second – Wis Burke Ideal, in the third – Reflection Sovereign. Growing and fattening of bulls was carried out up to 18 months of age and live weight of 470.2 kg; 461.7 and 474.3 kg, respectively, in groups. Control slaughter was carried out on three heads from each group. The quality of meat and physical and chemical parameters were studied. It was found that most of the dry matter (27.34 %) was in the meat of bulls of the first experimental group. At the same time, the protein was 2.04% less than in the third group and 1.22% less than in the second experimental group. Studies of the chemical composition of the longest back muscle showed that protein is also more in the meat of animals of the third experimental group (Reflection Sovereign line). In the study of amino acids, the protein quality index is higher in the second group (Wis Burke Ideal line). It was 4.65 against 4.54 and 4.58 in the other groups. Research of water holding capacity, tenderness (hardness), the index of pH, marbling was conducted. According to these indicators, the third group of animals belonging to the Reflection Sovereign line is distinguished. Thus, the belonging of bulls to different lines has a certain value and has a significant impact on the quality of meat.

Keywords: bulls, Holstein breed, lines, meat quality, amino acids, protein quality index.

INTRODUCTION

It is known that in recent years there has been a decrease in meat and beef production not only in

the Central Black Earth region, but also in the Russian Federation as a whole. The consump-

tion of beef per unit of population has decreased. According to scientifically based standards, according to the Institute of Nutrition of the Academy of Medical Sciences, meat consumption per capita should be 80 kg including 32 kg (40 %) of beef. To date, the average consumption of beef per person is no more than 15 kg.

In this regard, at the present time, the main objective of livestock is the increase of beef production and improving its quality.

The task is quite feasible. There are several ways to solve this problem. The main one is the increase in the number of beef cattle and its breeding in those regions where there is a sufficient number of pastures. Many studies have shown that the cattle meat breeds can under the same conditions to produce much more than from dairy and combined breeds. Young growth of meat breeds is capable to show good average daily gains in short terms and to reach high live weight. For example, young animals of Aberdeen-Angus breed, which is characterized by maturity, at 14 months of age has a live weight of 450-480 kg or more. From animals of Charolais, Hereford, Limousine and other meat breeds, you can get higher gains. However, over the past 25-30 years the number of meat breeds has not increased. Its specific weight averages 2.5-3.0 %. Such data, judging by the literature sources, can be observed in the last two or three decades [1, 2, 3, 4, 5, 6].

Most of the authors came to the point of view that at present and in the near future the main amount of beef is received, and will be received in the country from dairy cattle and combined breeds. This is evidenced by numerous studies conducted by staff and postgraduates of the Central Black Earth region (O.S. Dolgikh, L.I. Kibkalo, N.I. Tkacheva, A. A. Manshin, V.V. Gudymenko, S.N. Saenko, N.V. Sidorova, O.V. Gromenko, L.I. Sannikov, etc.). In researches it is established that the reserve of reception of beef are animals of the dairy and dairy-meat direction of productivity. From animals on fattening high average daily gains (850-950 g) were received and live weight in 14 months of age, exceeding 400 kg or more.

In the Central Black Earth and Central regions, the use of available reserves can significantly increase beef production. For this purpose, agricultural enterprises have all the possibilities.

Purebred young growth is also one of the significant reserves in the production of beef. High growth bulls are able to show at a young age. At the same time, labor costs are significantly reduced. At intensive cultivation of young growth on meat it is recommended to use the most valuable and highly nutritious forages in the quantity providing good gains in all periods of life (750-850 g a day) [7, 8, 9, 10].

In the experience of T.O. Groshevskaya (2013) Holstein bulls of Black-pied colour at a rate of 25-27c feed units per animal and 180-200 kg of digestible protein at the age of 16 months reached a live weight of 453-472 kg. High gains were obtained in different periods of cultivation. Heavy carcasses (256-267 kg) were obtained from animals aged 16 months. The carcass yield was more than 58 % higher. 45.7 kg of pulp accounted for 100 kg of pre-slaughter animals. A high index of the meat was obtained [10, 11, 12].

At calculating the economic efficiency of bull-rearing, it was found that the level of profitability reached more than 28 %. Thus, it is established that intensive cultivation should be carried out up to 16 months of age when reaching a live weight of 453-472 kg and the total cost for this period within 27 kg of feed units. Based on numerous studies of the development of beef cattle in the Central Black Earth region, the following conclusion can be made.

Important attention should be focused on improving the quality while increasing the number of beef, as this problem remains unresolved in many regions of our country.

In the Central Black Earth and Central regions there is a sufficient number of highly promising breeds, types and lines of cattle, and the timely implementation of existing recommendations and information on their cost-effective use will lead to an increase in the production of high-quality beef. In connection with the above, the subject studied is timely and relevant.

The purpose and objectives of the study.

The purpose of the research was to study the influence of the line accessory of bull-calves on their productive indicators.

The following tasks are set to achieve the goal:

- at growing bulls of different lines to investigate their growth and development;
- to study meat productivity of animals of different groups;
- to evaluate the qualitative indicators of meat productivity.

METHODS AND MATERIALS.

The studies were conducted in the conditions of LLC AP “Druzhba” in Pogarsky district of Bryansk region in the period from 2015 to 2018. The experiment was carried out on three groups of Holstein animals. Bulls of S. S. twin line were included in the first group, of W.B. Ideal line – the second, R. Sovereign line – in the third.

It is known that one of the important conditions for obtaining comparable and reliable data in scientific and economic experience is the correct acquisition of groups of animals. According to the principle of analogues, groups (mass, sex, age) were completed. 12 heads of bulls were included in each experimental group, which made it possible to calculate more objectively the economic efficiency.

Diets for intensive growing of bulls were based on the feed available on the farm. In winter, silage, hay, haylage, mixed fodder and mineral feed were introduced into the rations.

With the purpose of studying of meat efficiency of bull-calves control slaughter of animals aged 18 months and 3 heads of each group was performed. The mass of carcass, bones, fat was determined according to the method. In the average meat sample moisture, fat, protein, ash content was determined. In the longest muscle – color, pH, humidity, the presence of amino acids.

Caloric content was determined by calculation. The quality of meat and fat was determined in the educational and scientific innovation center “Agrotechnopark” at the Belgorod State Agrarian University named after V.Ya. Gorin.

The content of tryptophan was determined by the method of Graham and Smith. Hydroxyproline was determined by the Newman and Login method using the method of acid hydrolysis of meat by Verbitsky. Protein quality index was

calculated in relation to tryptophan and hydroxyproline.

Among the factors that affect the results of cultivation, the conditions of care and maintenance of animals are important. The farm is used fastened and loose housing maintenance of young cattle. The effectiveness of loose housing is explained by the reduction of labor costs for livestock production.

In our experience, all three groups of bulls were kept loose, starting from 15-20 days of age. Before that, they were in individual cells. In winter, the experimental young animals were kept indoors, and in summer – in the yards, i.e. special areas, fenced near the premises.

Indoors the animals were kept on deep straw bedding. Cleaning of manure from the premises was carried out by bulldozer two or three times per season.

The farm developed a scheme of feeding calves up to 6 months of age, according to which the bulls drank 250 kg of whole milk and 500 kg of milk. For roughage calves were taught from 10 days of age, concentrated – from 15-20 days, to juicy feed – from the second month.

In winter, bulls were given hay, roots, silage, haylage and concentrates. In the summer, green fertilizing was used. In the structure of the diet of young animals aged 6 to 12 months roughage (hay, straw) amounted to 20-30 %, juicy (silage, roots) – 50-60, concentrated feed – 20-30% feed per one day. In all seasons of the year in the diets of bulls mineral feed (salt, chalk) was implemented.

Feeding of experimental bulls was carried out according to the scheme for calves of dairy and dairy-meat breeds grown for meat. As a result, the feeding of calves ensured to 6 months live weight of 160-185 kg. The diets for the experimental calves accounted under the provisions of UIAH. The average daily growth was calculated in the range of 800-850 g.

RESEARCH RESULTS.

Importance is attached to the quality of meat and meat products. For the person of brainwork lean meat is required. Therefore, the country is conducting numerous studies to get an answer to this question.

There are several indicators to determine the quality of meat. Therefore, various studies should be carried out to prove the positive characteristics of beef.

Adipose tissue is of great importance. It is used as a reserve of energy of the body. In addition, if the fat in the pulp is evenly distributed, the product made from this meat is more tasty, juicy, tender and nutritious.

Table 1 – Chemical composition of average samples of meat, %

Indicator	Groups of animals		
	first	second	third
Moisture	72,66±1,39	75,02±1,42	75,21±1,38
Dry matter	27,34±0,59	24,98±0,63	24,79±0,72
Including: fat	7,31±0,35	4,00±0,29	2,80±0,43
ash	1,04±0,02	1,17±0,03	0,96±0,02
protein	18,99±0,37	19,81±0,28	21,03±0,35
Caloric value, kJ	745	633	614

The data of table 1 show that most of the dry matter was in the meat of bulls of the first experimental group (27.34 %). In the second and third groups, this indicator did not differ (24.98 and 24.79 %). If we talk about fat, the meat of bulls of the first group contained it by 3.31% more than in the second and by 4.51% more than in the third group. The opposite result is obtained from the protein content. Here, on the contrary, the advantage of the bulls of the third group, the meat of which had 21.03% protein,

Table 2 – The chemical composition of the longest muscle, %

Indicator	Groups of animals		
	first	second	third
Dry matter	25,13±0,75	29,13±0,68	28,36±0,82
Moisture	74,87±1,32	70,87±1,29	71,64±1,34
Protein	20,64±0,75	21,32±0,66	22,01±0,84
Fat	3,56±0,86	6,74±0,77	5,33±0,69
Ash	0,93±0,02	1,07±0,03	1,02±0,02
Total nitrogen	3,30±0,16	3,41±0,14	3,52±0,18
Fiber	18,64±0,17	19,38±0,15	20,63±0,12
In 1 kg meat, kJ	635	778	739

In the meat of the longest back muscles more dry matter was contained in the second group. The difference with the first and third groups was 4.03 and 0.77%, respectively. Moisture was contained more in the meat of bulls of the first experimental group, respectively, by 4.0 and 3.23% in groups.

At the same time, it should be noted the higher protein content in the meat of animals of the third group (Reflection Sovereign line). Apparently, the bulls belonging to one or another line

The nutritional properties of meat are characterized by chemical composition, which is influenced by various factors: breed, sex of animals, level and type of feeding, weight, age and others.

We studied the chemical composition of meat in the middle sample, and the results are presented in table 1.

which is more than in the first group by 2.04% and in the second – by 1.22 %. Caloric content of meat is higher in bulls of the first group. Probably it is influenced by the fat content. In the third group caloric content is lower by 131 kJ, in the second – by 112 kJ, in comparison with caloric content of meat of the first group.

In our research, we also studied the properties of the longest back muscle. Chemical analysis was carried out in the laboratory and the obtained materials are grouped in table 2.

has a specific meaning and has an impact on the quality of the meat. Fat in the meat of the longest muscle of bulls of the third group was greater than in animals of the first group by 1.77 % and less than in the second experimental group by 1.41 %.

The amount of total nitrogen in the meat of bulls of the third group contained 3.52% against 3.30 and 3.41 % in the meat of animals of the first two groups.

The caloric content of meat was slightly higher in animals of the Wis Burke Ideal line (the second group) in comparison with the third group. The difference was 39 kJ, probably due to the high content of fat in the meat. With the third group, the difference was 143 kJ.

The basis of muscle tissue is protein. In this regard, scientific studies determine the presence of amino acids – interchangeable and essential.

In connection with the change in consumer requirements in recent years, the quality of meat is of great importance and a greater number of indicators is studied. On the basis of these parameters it is difficult to judge about the influence of breed, sex of the animal and composition of diet on nutritional value of meat.

In scientific laboratories recently they determine presence of amino acids and primarily study the interchangeable and essential amino acids. To do this, they determine the presence in the meat of hydroxyproline and tryptophan. Then, according to their ratio, the protein quality index is calculated,

which should be not lower than 5.0, if we talk about high quality meat.

The content of tryptophan was determined by the method of Graham and Smith, using the method of alkaline hydrolysis by Verbitsky and Dataradge. Hydroxyproline was determined by the Newman and Login method using the method of acid hydrolysis of meat by Verbitsky.

With the acid method of determining tryptophan, it is destroyed, so alkaline hydrolysis is used. In this regard, the meat sample was previously degreased. To isolate hydroxyproline, muscle tissue is hydrolyzed with hydrochloric acid. The data that we have obtained in the course of research are shown in table 3.

From table 3 we can see that tryptophan is contained in the meat of bulls of the second group by 0.12% more than in the first and 0.11% more than in the third experimental group. Oxyproline is also more contained in the meat of bulls of the second group, although this difference is insignificant.

Table 3– Presence of amino acids in meat, %

Indicator	Groups of animals		
	first	second	third
Oxyproline	0,24±0,06	0,26±0,03	0,24±0,05
Tryptophan	1,09±0,08	1,21±0,07	1,10±0,8
PQI	4,54	4,65	4,58

As a result of the higher content of tryptophan in the meat of bulls of the second experimental group (Wis Burke Ideal line) protein quality index is higher. It was 4.65 against 4.54 and 4.58 in the other groups.

If we talk about the high quality of meat, the protein quality indicator according to the Institute of Nutrition should be within 5.0-7.0.

In this case, we can say that when growing and fattening Holstein bulls of different linear accessories they can produce high quality beef and remove animals from fattening weighing 470,2-474,3 kg at the age of one and a half.

In our example, the animals of all three groups had a high live weight, although in this respect the bulls belonging to the Reflection Sovereign line (the third group) stood out.

For a comprehensive study of the quality of meat, we conducted studies of moisture capacity, tenderness, intensity, pH index, and marbling. On these indicators the taste of meat and its nutritional value depends largely. Materials on these studies are given in table 4.

Analyzing table 4, it can be concluded that the meat of animals of the second experimental group (Wis Burke Ideal line) has a higher moisture capacity – 63.02 %. Moisture capacity is the specific weight of moisture from the mass of meat. The third group (the line of bulls R. Sovereign) in this respect takes the first place. It is followed by a group of bulls of the S. S. twin line – the first group.

Table 4 – Physical and chemical parameters of the longest back muscle

Indicator	Groups of animals		
	first	second	third
Moisture capacity, %	48,80±1,52	63,02±1,58	44,50±1,69

Tenderness (stiffness), g/cm ²	279±2,97	251±3,25	242±3,71
Color intensity	330±3,65	300±3,84	250±3,69
pH	5,67±0,25	5,68±0,33	5,71±0,26
Marbling	4,03±0,16	5,13±0,24	5,43±0,18

The meat of animals of Reflection Sovereign line (the third group) was more soft, followed by stiffness of the second group and the meat of calves belonging to the Sunnyside Standout twin line (the first group) was the most rigid.

An indicator of meat quality – pH – is normally in the meat of all groups of experimental calves. This suggests that the course of post-slaughter processes in the meat is normal. This indicator can have different fluctuations at different times and depends on the breed of the animal, sex, age, time of slaughter after its transportation to the meat processing plant and other reasons.

We carried out control slaughter of test bulls directly “from the wheels”, so that the animals were at rest, and this had a positive impact not only on the preservation of meat productivity losses, but also on the normal course of the meat pH.

We did not find any connection between the studied indicators.

In conclusion, it can be noted that according to the available indicators (moisture capacity, tenderness (stiffness), color intensity, marbling) preference should be given to animals of the third experimental group belonging to the Reflection Sovereign line.

DISCUSSION OF THE RESULTS.

The main amount of beef has been received for a long time and is continued to be received in our country from dairy cattle and combined breeds. The fact that the main source of high-quality beef can be beef cattle; much has been said and written in scientific and other various literature. Moreover, the main parameters of the development of beef cattle breeding in the near future were specified.

The share of beef cattle, as noted by many scientists, should be at the level of 12-15 %. Currently, the proportion of animals is not more than 2.5 percent.

In recent years, the share of Aberdeen-Angus cattle has increased. According to G.A. Sharkaeva, V.I. Sharkaeva (2017) in the country 190

thousand (87 %) of the Aberdeen-Angus are contained, 16.4 thousand head of Hereford cattle (7.5 %). Other meat breeds range from 0.1 to 2.6 %.

In other words, the proportion of meat breeds does not increase. If 20-30 years ago their share was 2.5-3.0 %, now this figure has decreased.

Hence there is a conclusion, the main amount of beef now and in the near future in the country will receive at the expense of dairy cattle and combined breeds.

Taking into account this fact that the share of Holstein and Holsteinized cattle has increased in Russia, these animals will be one of the main reserves of beef production of high quality.

That is why we conducted research on Holstein breed, taking into account the belonging of animals to different lines. Such studies are rarely mentioned in the literature.

CONCLUSIONS.

1. Analysis of meat quality showed the presence of high protein content in the longest back muscle of bulls of the Reflection Sovereign line. Fat was more by 1.77% than in animals of the first group and less than in the second experimental group by 1.41%.
2. Protein quality index was higher in the second experimental group (Wis Burke Ideal line) due to the higher content of tryptophan. It was 4.65 against 4.54 and 4.58 in the other groups.
3. According to the available indicators (moisture capacity, tenderness (stiffness), color intensity, marbling) preference should be given to the animals of the third experimental group belonging to the Reflection Sovereign line.

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