DOI https://doi.org/10.30525/978-9934-26-316-3-15

THE INFLUENCE OF THE TYPE OF FEEDING ON MEAT PRODUCTIVITY OF YOUNG CATTLE AND MEAT QUALITY

Razanova O. P., Farionik T. V., Skoromna O. I.

INTRODUCTION

Cattle breeding as part of the agro-industrial complex occupies a leading place in the developed countries of the world. The level of development of this industry is decisive in ensuring the food independence of the country. Growing demand for livestock products has caused significant changes in food systems around the world. One of the important strategic tasks of the development of the domestic agro-industrial complex is the development of meat and dairy-meat cattle breeding, the purpose of which is to increase meat production to provide the population of Ukraine with high-quality meat products of own production and the production of high-quality food raw materials. Such meat has a significant demand on the meat market and increases the competitiveness of this type of product on the world market. In recent years, the demand for beef has been insufficiently met, and often its quality does not meet the demands of consumers. Beef is one of the most important types of meat raw materials in animal husbandry. It belongs to the red varieties of meat and has the most attractive nutritional and taste qualities. In Ukraine, the number of beef cattle is small, so beef is obtained at the expense of dairy cattle, mainly culled heifers, steers and culled cows. In Ukraine, most livestock enterprises specialize in the development of the dairy industry. Therefore, it is currently impossible to increase beef production exclusively due to the intensive development of beef cattle in the direction of productivity.

More than 95% of beef in the country is obtained from dairy and combined cattle. In the farms of our country, among the dairy breeds of cattle, the Ukrainian black and spotted dairy breed is the most concentrated.[1]. The fattening young have good meat indicators and at the age of 12 months reach a live weight of 380-400 kg, at the age of 18 months – 500-520 kg.

The meat market is an important component of the country's food market, the standard of living of the population and ensuring the country's food security largely depend on the stability of its functioning. Meat and meat products are among the most important food products. Meat production is one of the main issues in solving food security, providing the country's population

[1] Nogalski Z., Pogorzelska-Przybyłek P., Sobczuk-Szul M., Purwin C., Modzelewska-Kapituła M. Effects of rearing system and feeding intensity on the fattening performance and slaughter value of young crossbred bulls. *Annals of Animal Science.* 2018. Vol. 18. P. 835–847.

with complete dietary protein. Indicators of consumption of livestock products per capita are one of the main indicators characterizing the well-being of the nation[2].

Solving this problem is possible through the breeding of dairy and mixed breeds of livestock, the development and implementation of a set of measures capable of more fully realizing the genetic potential of meat productivity of animals. In this regard, the increase in the productivity of animals is realized on the basis of improving the conditions of keeping, feeding, raising the level of breeding work. In the complex of measures aimed at increasing the meat productivity of young cattle, a special place is given to the quality of feeding, which is achieved by high quality feed, sufficient quantity and optimal ratio of feed components in diets, as well as the use of various biologically active substances and feed additives.

1. The problem's prerequisites emergence and the problem's formulation

The productivity of fattening young cattle is most influenced by balanced feeding, which is based on the needs of animals in various types of nutrients, vitamins, and mineral elements.

The basis of successful breeding of cattle is the fodder base, which uses scientifically based feeding, which ensures maximum productivity of animals with low costs of labor and resources. Farms engaged in breeding and growing cattle for meat are mostly not provided with a stable feed base that would meet the needs of animals in nutrients such as feed protein, phosphorus, carotene, trace elements, vitamins and enzymes. For the production of beef with a minimum fat content, which is necessary to obtain meat with a small marbling, it is necessary to intensively grow calves until they reach the desired live weight at the age of 15-17 months, steers – at the age of 18-22 months. Animals of different sexes and age groups are fattened, depending on size and type, in such a way as to make the most of their growth characteristics and achieve the best combination of live mass with the desired carcass composition[3].

During intensive breeding and fattening, when average daily gains exceed 1000 g, the type of feed can only be concentrated (from 56 to 77% or more), for this the concentration of exchangeable energy in 1 kg of dry matter should be 10-12 MJ, because the animal does not able to eat more food with a lower concentration of exchangeable energy. It is possible to use different rations for growing and fattening young animals, but the higher the average daily

[2] Сегеда С.А. Статистичний аналіз споживання м'яса та м'ясопродуктів в Україні. *Міжнародний науково-виробничий Журнал «Економіка АПК»*. 2020. № 3 С. 36–46.

[3] Кандиба В.М., Ібатуллін І.І., Костенко В.І. Теорія і практика нормованої годівлі великої рогатої худоби : монографія. 2012. 860 с.

growth is planned, the higher the concentration of exchangeable energy and the quality of feed or the greater the proportion of concentrates in the ration. The amount of concentrates given to animals should be increased daily by no more than 150-230 g per head to prevent overfeeding.

Depending on the composition, feed additives are divided into protein, protein-vitamin and protein-vitamin-mineral supplements. Premixes include biologically active substances: vitamins, trace elements, antibiotics, antioxidants, enzymes and others. The use of feed additives in the rations of animals helps to increase productivity. At the same time, in animals, there is an increase in the conversion of feed nutrients into meat products[4].

When balancing rations, one should always remember the effect of the law of the minimum in the body, that is, the physiological feature of animals – the body works on the minimum intake of nutrients with feed.

According to this feature, the body can have everything, but if there is not enough, for example, protein or some essential amino acid, then when using vitamins, trace elements or other biologically active substances, it will be impossible to increase productivity. It has been established that animals with genetically determined high productivity are at greater risk, and thus for them the level of feeding and the balance of the diet is more important. As a result of experimental studies, a positive effect on feed intake and digestibility, an increase in the intensity of use of nitrogen, phosphorus and calcium when introducing special mineral additives into the diet of livestock, including young animals, was established. Research by many scientists has proven that by adjusting the composition of diets, it is possible to significantly change the intensity of animal body development, the activity of certain organs and tissues, and, as a result, the animal's exterior.

The technological cycle of growing over-repaired young animals, which consists of the dairy post-milking period and the fattening period, has its own peculiarities in feeding and keeping animals. The division of the technological cycle into a dairy period and a period of intensive breeding of steers from 6 months of age to slaughter requires the maximum use of the genetic potential of animals, feed, energy and resources due to the optimization of a complex of technological elements. The second direction is to increase the level of transformation of the energy of the technological process into the energy of weight gain of steers with the maximum positive influence of the breed factor, the factors of the level of feeding and the type of rations using new methods of increasing the consumption of dry matter of feed by animals.

[4] Orikhivskyi T. V., Fedorovych V. V., Mazur N. P., Pirlog A. Dynamics of early growth of heifers of simmental breeds of different production types. *Scientific and Technical Bulletin of State Scientific Research Control Institute of Veterinary Medical Products and Fodder Additives and Institute of Animal Biology*. 2019. Vol. 20. № 2. P. 366-374.

The third direction can be called the optimization of animal keeping parameters and the microclimate of premises to reduce energy consumption and increase the level of productive use of feed. The problem of increasing the rate of beef production is quite important in solving the tasks of the country's agro-industrial complex aimed at ensuring food security. In animal husbandry, in the direction of increasing the meat productivity of livestock, considerable attention is paid to the organization of complete, balanced feeding in terms of all nutrients. The full value of feeding animals is achieved by a sufficient level of feeding, improving the quality of feed, the most favorable ratio in the diet of the main components. Enriching rations and compound feeds with special additives of biologically active substances is important in achieving a high level of biological completeness of animal feeding. For this purpose, various feed additives are used, which increase metabolism, stimulating the body to produce more products and reduce feed costs per unit of production[5, 6,7]. They are introduced in small quantities, but contribute to the intensification of metabolic processes, stimulation of the functional reserves of the animal body, and the formation of immunity, which ultimately has a positive effect on the level of productivity. The use of premixes in the fattening of steers, in particular protein-vitamin-microelement premixes, promotes more intensive growth of animals, improves meat productivity and meat quality[8], reduces feed costs and, accordingly, increases the profitability of cultivation [9, 10, 11]. Mineral substances, in particular, microelements, have a special place in complete feeding of animals [12].

---

[5] Гончарук А. П. БВМД «Інтермікс» у раціонах відгодівельних свиней. *Науковий вісник Львівського національного університету ветеринарної медицини та біотехнологій імені С. З. Ґжицького*. 2016. Вип. 18. № 67. С. 52–57.

[6] Razanova O. P. Increasing meat quality quails fed by biological active additives based on submerged bees. *Ukrainian Journal of Ecology.* 2018. Vol. 8. № 1. P. 631-636.

[7] Poberezhets J., Chudak R., Kupchuk I., Yaropud V., Rutkevych V. Effect of probiotic supplement on nutrient digestibility and production traits on broiler chicken. *Agraarteadus.* 2021. Vol. 32 (2). P. 7.

[8] Girard I., Aalhus J., Basarab L., Larsen I. L., Bruce H.L. Modification of beef quality through steer age at slaughter, breed cross and growth promotants. *Canadian Journal of Animal Science*. 2012. Vol. 92. P. 75–188.

[9] Niedermayer E. K., Genther-Schroeder O. N., Loy D.D., Hansen S. L. Effect of varying trace mineral supplementation of steers with or without hormone implants on growth and carcass characteristics. *Journal of Animal Science.* 2018. Vol. 3. № 96. P. 1159-1170

[10] Мазуренко М. О., Гуцол А. В., Єфимчук С. М. Вплив годування БВМД Інтермікс на продуктивність телят. *Науковий вісник Львівського національного університету ветеринарної медицини та біотехнологій імені С. З. Ґжицького.* 2015. Т. 17. № 61. С. 109-113.

[11] Денькович Б.С., Півторак Ю.І., Гордійчук Н. М. Вирощування племінних теличок за використання концентрату «Інтермікс-теля 30%». *Науковий вісник Львівського національного університету ветеринарної медицини та біотехнологій імені С. З. Ґжицького. Серія: Сільськогосподарські науки.* 2017. Вип. 19. № 74. С. 147-151.

[12] Kincaid R. L. Assessment of trace mineral status of ruminants: a review. *Journal of Animal* Science. 1999. Vol. 77. № 1. P. 1–10.

According Fediuchka et al.[13] at the basis of rational feeding of young cattle, great importance is attached to mineral feeding, and they determine the effectiveness of the use of vitamin-mineral and protein-vitamin-mineral supplements in the rations of calves. It should be noted that the consumption of different sources of microelements led to different effects on the slaughter parameters on the qualitative composition of the carcasses of Cattle sheep. Tsup et al.[14] recomendet use a phytopremix based on purple echinacea to increase the intensity of their growth by 16% against the background of reducing feed costs by 5.1%, improving indicators of non-specific resistance when growing calves.

Studying only growth indicators cannot sufficiently characterize the features of animal development, and does not provide a complete picture of meat productivity and meat quality. More accurate and objective data can be obtained only after slaughtering the animals. Slaughter indicators of animals provide a more complete description of the quality and quantity of meat compared to lifetime indicators of live weight and average daily gains. Quantitative and qualitative parameters of carcasses were evaluated to characterize the meat productivity of cattle. Quantitative indicators of meat productivity of livestock are pre-slaughter weight, slaughter weight, paired carcass weight, internal fat mass, carcass yield, fat yield and slaughter yield.

The main indicators of the meat qualities of animals are the mass of the carcass and its morphological composition. Senichenko[15] experimentally proved that it is economically beneficial to use the vitamin-mineral supplement «Zhyvyna» with a mineral complex in the feeding of calves of the Ukrainian black and spotted dairy breed. A 1.7% higher carcass yield was obtained when the supplement was fed. *Prilipko & Zakharchuk*[16] it was found that the use of E-selenium and Devivit additives in the diets of Simmental bulls against the background of balanced feeding increases the average daily gain of live weight, as well as slaughter weight – by 3.2-4.5%.

The transfer of animal husbandry to an intensive technology involves the development of new forms and methods of growing and fattening, which ensure an increase in animal productivity, an improvement in the quality of products while reducing the cost of labor and resources. The system of intensive breeding

[13]Федючка М., Молярчук П., Світельський М., Ревунець А. Вплив мінеральних добавок на ріст і розвиток молодняку ВРХ. *Тваринництво України.* 2010. № 11. С. 32–34.

[14] Цуп В.І., Тихонова Б.Є., Федорович В.С. Використання ехінацеї пурпурової у складі мінеральновітамінного премікcу при вирощуванні телят. *Науковий вісник Львівського національного університету ветеринарної медицини та біотехнологій імені С.З. Гжицького*. 2015. Вип. 17. № 3. С. 337-342.

[15] Сеніченко В.Ю. Економічна ефективність використання «Живини» у годівлі телят. Органічне виробництво і продовольча безпека. Житомир, 2018. С. 558–561.

[16] Прилипко Т.М., Захарчук, П.Б. Показники продуктів забою бичків залежно від селеновмісних добавок у раціоні. *Біоресурси і природокористування.* 2019. Т. 11. № 1-2. С. 146-155.

of young cattle for meat should be based on knowledge of the processes of formation of meat productivity, patterns of growth and development of animals, which has great practical value. In the feeding of young cattle when grown for meat, the most important period is the milk period.

Growing and feeding conditions in the initial period of life play a special role[17]. Taking into account the perspective and relevance of the use of microelements in raising bulls at an early stage of ontogenesis, taking into account the insufficient study of the problem, there was a need to conduct this study.

The body of calves during the period of active growth and development needs a significant amount of mineral elements. The use of feed additives in livestock rations makes it possible to improve the digestibility of nutrients in the diet, which, in turn, contributes to the strengthening of protein, carbohydrate, and lipid metabolism, increasing the production of meat products by increasing its quantity. Mineral and vitamin nutrition is one of the main factors in raising animals. Young animals are especially sensitive to the lack of minerals and vitamins during the milk growing period. With long-term and insufficient intake of them in the body, metabolic processes are disturbed, various diseases occur, animal growth is restrained and the costs of cultivation increase. Therefore, it is necessary to feed full-fledged vitamin and mineral supplements to calves, which ensure the normal course of biochemical processes in the body[18].

A number of scientists believe that the importance of minerals (calcium, phosphorus, potassium, sodium, iron, copper, cobalt, zinc, manganese, iodine, selenium) in the feed of farm animals is extremely high, although they have no energy value[19]. In feeding cattle as a source of minerals, compound feed with the addition of natural mineral additives is used, which ensures an increase in the intensity of growth and development and improvement of quality indicators of meat [20, 21]. In today's conditions, scientific research is focused on the fuller implementation of the physiological features of the

[17] Даньків В.Я., Постол О.І., Зінкевич В.І., Венгрін Я.Д. Вплив згодовування білково-жиро-мінеральної добавки телятам у молочний період на гематологічні показники та активність ферментів в крові. *Сільський господар.* 2012. № 9-10. С. 22-24.

[18] Довгій Ю.Ю., Котелевич В.А., Сеніченко В.Ю. Вплив вітамінно– мінеральних комплексів на морфологічні і біохімічні показники крові телят. *Збірник наукових праць.* Болгарія, Софія. 2019. С. 22–29.

[19] Glombowsky P., da Silva A.S., Soldá N.M. Mineralization in newborn calves contributes to health, improve the antioxidant system and reduces bacterial infections. *Microbial Pathogenesis*. 2018. Vol. 114. P. 344-349.

[20] Фурманець Ю.С. М'ясна продуктивність бичків абердин-ангуської породи при згодовуванні у складі комбікормів цеолітових туфів. *Науковий вісник Львівського національного університету ветеринарної медицини та біотехнологій імені С.З. Гжицького*. 2010. Т. 12. № 2 (44). Ч. 3. С. 250-2 54.

[21] Gorlov I. F., Trukhachev V. I., Randelin A. V., Slozhenkina M. I., Shlykov S. N. Forming the quality indicators to beef by feed additives «Yoddar-Zn» and «Glimalask-Vet». *Research Journal of Pharmaceutical, Biological and Chemical Sciences*,. 2016. Vol. 7. № 3. P. 2323.

animal body, increasing their productive indicators, nutritional and veterinary-sanitary quality of products[22].

Studies on the use of micro-additives of deficient trace elements (J-, Se2+, Co^{2+}, Fe^{2+}, Mn^{2+}, Zn^{2+}) in the form of inorganic salts or their methionates of trace elements, in the form of chelated compounds (methionates and lysinates) in the diets of fattening cattle confirm their positive effect on erythropoiesis, respiratory blood function, separate areas of protein, energy and carbohydrate metabolism in the body of young cattle. The addition of such additives to the diet improves the energy and biological value of the diets, which, in turn, contributes to the increase in the intensity of growth of calves while simultaneously reducing the total cost of feed for growth.

2. The influence of the concentrated type of feed and salts of microelements on the production of beef from young cattle of different breeds

The improvement of the above elements of beef production technology in dairy farming in the context of its theoretical justification has an insufficient degree of development, which determines the relevance of the chosen research topic.

Providing the country's population with food products, including meat, is the most important task of the agro-industrial complex of Ukraine.

Currently, more and more attention is paid to solving issues related to increasing beef production.

The purpose of the research was to study the influence of the concentrated type of feed and salts of trace elements on the production of beef from young cattle of different breeds.

The first two months of raising bulls determine the course of growth until the animals reach maturity. The first weeks of life are crucial in the development of internal organs. In the first six months, meat-producing animals have maximum growth energy. A biological feature of a young organism is its plasticity, which allows you to change and develop useful traits in any direction through the purposeful influence of food factors on them. Also, a feature of young animals is their ability to give high growth rates with relatively economical energy consumption. In connection with the intensive metabolic processes in the body of calves and the rapid growth of bone tissue, they must be provided with complete feed containing a sufficient amount of protein, minerals and vitamins. Any, even temporary, lack of nutrients negatively affects the growth and development of animals.

[22]Яремчук О. С., Фаріонік Т. В., Разанова О. П., Скоромна О. І., Ушаков В. М. Наукові підходи обгрунтування щодо використання мікроелементних хелатних сполук за виробництва яловичини в умовах дефіциту мікроелементів : монографія. Вінниця: ТОВ «Друк», 2022. 196 с.

According to most scientists, the level of feeding should contribute to the cultivation of animals of the desired type and strong constitution. Obtaining such animals is possible with a sufficient level of feeding, which ensures an average daily increase in live weight of 900-950 g for dairy and meat breeds and 900-1200 g for meat breeds. Thus, by the age of 18 months, the young grown, with the indicated daily gains, reach a live weight of 450 and 650 kg[23].

The function of minerals in the body of animals is quite large, and along with specific functions, minerals play an important role in maintaining osmotic pressure, nerve and muscle excitation, regulation of catalytic processes, and manifestation of the body's immunobiological reactivity.

The lack of minerals in the diet negatively affects the degree of mineralization of the skeleton, the health and life expectancy of animals, reproductive functions. According to the standards, with an average daily gain of 500 and 750 g, the need for calcium and phosphorus for calves should be 9.6 and 14 g, 6.2 and 9.0 g per head per day, respectively. Iron norms per 1 kg of live weight are 3.6 mg, copper – 0.2, magnesium – 10, zinc 0.8-1.0, potassium – 60-100, sodium – 32, chlorine – 36, manganese – 0.7, cobalt – 1.8 and selenium – 9 mg [3, 21].

When raising calves in the post-weaning period, it is necessary to take into account that this period coincides with the intensive growth of muscle and bone tissues, internal organs [24, 25]. Therefore, animal feeding plays the most important role, its organization should be based on modern ideas about the energy needs of animals and individual elements of feeding. It is necessary to adhere to the principle of standardized feeding of animals, taking into account the latest achievements of science. Only such an approach guarantees high productivity and effective cattle breeding.

In Ukraine, one of the farms engaged in fattening cattle of specialized meat breeds is the company «Livestock4Export». During the milking period, fattening young animals are given whole milk substitute (Table 1).

Whole milk substitute is made from dairy products with the addition of vegetable proteins and fats, enriched with a balanced complex of biologically active substances (vitamins, macro– and microelements), flavoring and aromatic substances that increase the appetite of animals. In the composition of whole milk substitute, 95% are dairy products. By nutrition, 20% is protein,

[23]Міхур Н.І. М'ясна продуктивність відгодівельних бугайців та якісні показники яловичини за різної структури раціонів. *Науковий вісник Львівського національного університету ветеринарної медицини та біотехнологій імені С.З. Ґжицького*. 2015. Т. 17. № 1(61). С. 128-134.

[24]Крук О. М'ясність телят української чорно-рябої молочної породи різного віку. *Тваринництво України*. 2015. № 5. С. 26-30.

[25] Moriel P., Arthington J. D. Effects of trace mineral-fortified, limit-fed preweaning supplements on performance of pre– and postweaned beef calves. *Journal of Animal Science.* 2013. Vol. 91. P. 1371-80.

15% fat, 47% lactose. The substitute is rich in the necessary mineral elements of calcium and phosphorus, which are 0.7 and 0.6% in this product, respectively.

Table 1

The composition of whole milk substitute for calves during the dairy growing period

Constituents	Indicator, %
Dairy products	95
White	20
Fat	15
Humidity	5
Cellulose	0.05
Ash	8.5
Lactose	47
Ca	0.7
P	0.6
Lysine	1.5

For feeding calves, take 100 g of whole milk substitute and dilute it in 1 liter of warm water at a temperature of 40 ^{0}C. Every day, 6 liters of milk substitute are drunk per head, 2 liters three times. Also, calves that are on drinking water are given combined feed from corn to stimulate the work of the rumen. Calves are kept on drinking water until they reach a live weight of 85-90 kg, while they should eat already 2 kg of concentrated feed per day. In the future, the animals are fed with a special compound feed, which in the diet contains 90% nutrition and straw – within 10%. Drinking and feeding animals at will. The recipe for compound feed used for feeding cattle on the farm is shown in Table 2.

Salts of microelements of iron, manganese, zinc, copper, iodine, selenium and cobalt are added to the components of compound feed. The nutritional value of compound feed in terms of exchangeable energy is 11.41 mJ/kg, crude protein is 14.78%. The ratio of calcium to phosphorus in the diet for over-repaired young is 1:1,4.

The problem of increasing the production of high-quality beef in the agricultural sector of our country is one of the most priority, which must be solved using the available genetic resources. Among the factors affecting meat productivity and fattening efficiency, the quality of the ration is important. Cattle of many specialized meat breeds, in comparison with dairy ones, are fattened faster, give a higher slaughter yield and better quality meat[26].

[26] Muller A., Burren A., Jorg H. Identifying ideal beef and dairy crossbreeds to optimise slaughter yields. Agrarforschung schweiz. 2015. Vol. 6. № 1. P. 28-35.

Table *2*

A recipe for compound feed and its nutrition for calves aged 4-10 months

Constituents			**Indicator, кg/t**
Premix			20.00
Sunflower meal			70.00
Soybean cake			35.00
Wheat			190.00
Alcohol bard			150.00
Corn			270.00
Barley			150.00
Sunflower oil			5.00
Bran			110.00
Supplements have been introduced 1 кg			
Vit. A, s. MO	7.00	Vit. $Д_3$, s. MO	1.80
Vit. E, mg	10.00	Vit. K_3, mg	1.00
Vit. B_1, mg	1.00	Vit. B_2, mg	3.00
Vit.B_3, mg	3.00	Vit. B_6, mg	1.00
Vit.B_5, mg	12.50	Vit. H_c(B9), mg	0.50
Vit. (B_7), mg	0.02	Vit. B_{12}, mg	0.02
Salts of trace elements			
Iron, mg	20.00	Manganese, mg	30.00
Zinc, mg	60.00	Copper, mg	8.00
Iodine, mg	0.50	Selenium, mg	0.20
Cobalt, mg	0.50		
The nutritional value of compound feed			
Exchange energy, mJ/kg	11.41	Crude fiber, %	6.35
Raw protein, %	14.78	Raw fat, %	3.36
Raw ash, %	5.35	Lysine, %	0.48
Methionine + cystine, %	0.59	Calcium, %	0.71
Phosphorus, %	0.48	Kitchen salt, %	0.65

In this regard, studies were conducted to study the influence of the type of feeding on the meat productivity of fattening young cattle in farm conditions «Livestock4Export». In the studies, generally accepted zootechnical methods were used: determination of live weight, average daily, and absolute growth. Live weight gains of steers were calculated using control weighings.

Weight growth was taken into account when the bulls arrived at the farm and at the end of the fattening period.

Weighing of experimental livestock was carried out before morning feeding and feeding Based on the weighing data, the following average daily, absolute and relative live weight gain were calculated.

Absolute and average daily gains in live weight according to the formulas: average daily gain:

$$C_{пр} = \frac{M_2 - M_1}{t}(г),$$

where: M_1 – mass at the beginning of the period;
M_2 – mass at the end of the period;
t – number of days between weighings.

Absolute growth:

$$A_{пр} = M_2 - M_1(кг)$$

The coefficient of increase in live weight was determined by the ratio of the live weight of steers at the end of fattening to the weight of calves at the time of testing. The feeding conditions of the bulls were determined by generally accepted methods by analyzing the completeness of the average animal feeding rations in different periods. Feeding with concentrated fodder (90%) and straw (10%) was carried out ad libitum throughout the fattening period. Accounting for consumed feed was carried out by the method of control feeding once a month by weighing the given feed and its residues.

The live weight of animals is one of the most important indicators in beef cattle breeding. The intensity of growth and development of farmed animals is influenced by many factors, including breed, physiological state of animals, keeping technology, diet composition[27]. In the conditions of the farm «Livestock4Export» studied the indicators of the intensity of growth of young animals in fattening breeds: Limousin, Simmental, Aberdeen-Angus. The duration of animal fattening was 172 days.

Limousin steers were fattened with an average live weight of 189.8 kg, Simmental – 199.6 kg, and Aberdeen-Angus – 188.5 kg. During the fattening period, the absolute growth of cattle limousines was 246,8 kg, Simmentals – 226.7 and Aberdeen Angus – 259.7 kg. For the obtained increase in live weight for 172 days of fattening, the average daily indicators were 1434 g, 1317 and 1510 g, respectively (table 3).

Aberdeen-Angus were characterized by more intense growth and had the highest average daily gains – 1510 g. The advantage over Limousin breed analogues was 5.3%, Simmentals – 14.6%. The obtained high average daily increases in the live weight of fattening steers at the «Livestock4Export» farm are due to a special feeding technology. The intensity of growth in the fattening young of the Aberdeen-Angus breed was higher by 2.8 and 9.1% compared to the Limousin and Simmental breeds. The post-slaughter meat

[27] Скоромна О.І., Гордій А.М., Голембівський С.О., Разанова О.П., Вікарчук Н. Ефективність розведення кросів бельгійської блакитної породи великої рогатої худоби в Україні. *Таврійський науковий вісник. Серія: Сільськогосподарські науки.* 2022. Вип. 125. С. 184-193.

productivity of animals is primarily evaluated by slaughter indicators, which are closely related to the live weight of animals. It is known that cattle of any breed can achieve high meat productivity with proper breeding.

Table 3

Intensity of growth of fattening cattle of meat breeds in farm conditions «Livestock4Export», M±n, n=20

Indicator	Breed		
	limousine	simmental	Aberdeen Angus
Live weight at the beginning of fattening, kg	189.8±1.8	199.6±2.9	188.5±1.7
Live weight at the end of fattening, kg	436.6±3.2	426.3±2.7	448.3±1.9
Absolute increase in live weight, kg	246.8±2.90	226.7±1.13	259.7±1.63
Average daily increase, g	1434±16.9	1317±6.5	1510±9.4
Relative growth, %	78.8±0.78	72.5±0.82	81.6±0.61

Meat productivity is characterized by quantitative and qualitative indicators of meat products obtained after slaughtering animals. An objective indicator of meat productivity is the result of slaughter, by which it is possible to judge not only the quantity, but also the quality of the obtained meat products. In order to study the influence of the type of feeding on the meat parameters of test steers, a control slaughter of young calves at the age of 16 months was carried out (five heads from each group).

The main indicators used to evaluate meat productivity were: pre-slaughter live weight, slaughter weight and slaughter yield, carcass morphological composition and the nature of fat deposition. Slaughter rates of Bugai cattle were studied according to the following indicators:

– pre-slaughter live weight, kg

– determined by weighing animals after fasting for 12 hours;

– slaughter weight of the carcass, kg

– weight of the carcass with skin, without head, legs, separated by wrist and hock joints and internal organs;

– slaughter yield, %

– the ratio of the slaughter mass to the pre-slaughter mass, expressed as a percentage.

The morphological composition of the carcasses was determined by the method of deboning after 24-hour exposure in a refrigerating chamber at a temperature of 0-4 ^{0}C, followed by the calculation of the meatiness coefficient

[28]. The mass of pulp, bones, tendons and cartilage was determined in the carcasses. To assess the meatiness of animals, the meatiness coefficient was mathematically determined as the ratio of the mass of muscle tissue to the mass of bones, cartilage and tendons, and the muscle-bone ratio, which was calculated by dividing the mass of flesh by the mass of bones. The flesh of the carcass after veining was divided into three grades: higher – pure muscle tissue without visible remains of connective tissue formations, I grade – the presence of no more than 6% of connective tissue formations, II grade – no more than 20% of connective tissue formations, the presence of tendons, films is allowed and small veins.

For the chemical analysis of the meat, an average sample of the longest back muscle was taken.

For the study of post-mortem parameters, fattening young animals of three breeds were selected: Simmental, Aberdeen-Angus and Limousin. Animals of these breeds had the same fattening period – 172 days.

Based on the results of the research, it was found that bulls of the studied breeds were characterized by good slaughter qualities, but animals of the Aberdeen-Angus breed were noticeably distinguished by meat productivity indicators (table 4).

Animals were selected for slaughter based on almost the same pre-slaughter live weight – 430-434.7 kg. But the slaughter yield in the three groups differed depending on the breed. The highest slaughter yield was obtained from bulls of the Aberdeen-Angus breed (60.3%), which is 4.6% more than Limousins, and 5.1% more than Simmentals.

Table 4

Slaughter rates of bulls depending on the breed, M±n, n=5

Indicator	Breed		
	Aberdeen Angus	**limousine**	**simmental**
Pre-slaughter live weight, kg	433.5±17.39	434.7±9.53	430.0±10.35
Slaughter weight, kg	261.5±10.98	242.1±6.08	237.3±7.14
Slaughter output, %	60.3±0.53	55.7±0.27	55.2±0.28
Weight of the steamed carcass, kg	249.2±16.6	233.4±6.11	230.1±6.70
Output of steam carcass, %	57.5±0.52	54.8±0.34	53.5±0.26
Mass of internal crude fat, kg	12.3±0.49	8.7±0.41	10.3±0.35
Output of internal raw fat, %	2.8±0.17	3.5±0.18	4.2 ±0.06

[28]Шкурин Г.Т., Тимченко О.Г., Вдовиченко Ю.В. Забійні якості великої рогатої худоби: методики досліджень. К. : Аграрна наука, 2002. 50 с.

According to the obtained data on the slaughter yield of Aberdeen Angus, a higher slaughter weight was obtained, namely more by 19.4 kg, or by 7.4%compared to Limousins and by 24.2 kg, or by 9.2% compared to Simmentals . Aberdeen-Angus breed bulls obtained a higher weight of paired carcass (249.2 kg), the advantage compared to Simmental and Limousin breed animals was 19.1 kg (7.7%) and 15.8 kg (6.3%), respectively.

Taking into account the higher indicators of the weight of the paired carcass, Aberdeen Angus obtained a higher yield of paired carcass (57.5%), which is 2.7% and 4.0 more compared to Limousins and Simmentals. The largest output of internal crude fat was obtained at the slaughter of Simmental breed dogs (4.2%), in Aberdeen-Angus and Limousin dogs it is less by 1.4 and 0.7%, respectively.

One of the main objects for evaluating the meat productivity of livestock is the carcass obtained after slaughtering the animal. The nutritional value of meat carcasses is determined, as is known, by the ratio of muscle, fat, connective and bone tissues included in their composition. Muscle tissue is the most valuable part of the carcass, its amount depends on various factors: fatness, age, genetic basis, feeding conditions, etc. The fleshy part of the carcass mainly determines the nutritional and commercial advantages of the meat. In our research, deboning of half-carcasses showed that the soft part of the carcass is the highest in Aberdeen-Angus bulls, their advantage over Limousins was 1.9%, Simmentals – 3.7% (table 5).

Table 5

Morphological composition of beef cattle carcasses, M±n, n=5

Indicator	Breed		
	Aberdeen Angus	limousine	simmental
Mass of chilled semi-carcass, kg	122.1±1.83	120.6±3.47	118.9±6.53
Mass of pulp, kg	97.4±1.56	95.6±2.39	93.9±5.69
Pulp yield, %	79.7±1.25	79.3±1.04	79.0 ±0.44
Bone mass, kg	22.1±1.02	22.3±1.08	22.9±1.30
Bone yield, %	18.1±0.58	18.5±0.24	19.3±0.46
Weight of tendons and cartilage, kg	2.6±0.15	2.6±0.09	2.9±0.18
Yield of tendons and cartilage, %	2.2±0.12	2.2±0.03	2.5±0.06
Yield of pulp per 1 kg of bones, kg	4.4±0.05	4.3±0.04	4.1±0.07

The yield of pulp in Aberdeen-Angus carcasses was 79.7%, which is more compared to Limousins by 0.4% and to Simmentals by 0.7%.

The weight of bones in Simmental carcasses is greater compared to Aberdeen Agnus and Limousin by 3.6% and 2.7%, respectively. Relative to half-carcass weight, the yield of bones in Aberdeen Angus and Limousin was the same, and in Simmentals it was higher by 0.3%. The yield of pulp per 1

kg of bones in the carcasses of Aberdeen-Angus cattle was 4.4 kg, which is 0.1 kg and 0.3 kg more compared to the Limousin and Simmental breeds, respectively. The weight of half-carcasses of first-class Aberdeen-Angus bulls was 2.2% higher than that of Limousin, and 7.9% of Simmental (table 6).

Table 6

Varietal composition of half of the carcasses of cattle of different breeds, M±n, n=5

Indicator	Breed		
	Aberdeen Angus	**limousine**	**simmental**
Half carcass weight, кг	122.1±1.83	120.6±3.47	118.9±6.53
Weight of cuttings by varieties, kg: first class	100.7±2.47	98.5±2.68	93.3±2.48
second grade	13.7±0.26	14.1±0.82	19.6±1.06
third grade	7.7±0.08	8.0±0.14	6.0±0.29
Yield of cuttings by varieties, %: first class	82.5±0.43	81.7±0.97	78.5±0.88
second grade	11.2±0.11	11.7±0.25	16.5±0.27
third grade	6.0±0.13	6.4±0.48	5.0±0.15

The amount of second-grade meat in half-carcasses of Simmental bulls was the largest (19.6 kg), the advantage over Aberdeen Angus and Limousin was 43.1% and 39.0%. The third grade of meat was more in half-carcasses of Limousin bulls compared to Aberdeen-Angus and Simmental breeds by 3.9% and 33.3%, respectively. The yield of meat in half-carcases of Aberdeen-Angus bulls compared to Limousin and Simmental counterparts is 0.7% and 4.0% higher, the second grade is lower by 0.5% and 5.3%, the third grade is lower compared to of the Aberdeen-Angus breed by 0.4% and larger by 1.0% compared to the Simmental breed. So, summarizing the obtained results regarding slaughter indicators, we can conclude that Aberdeen-Angus bulls differ significantly in terms of meat productivity. Under the same conditions of intensive cultivation, bulls of this breed are characterized by heavier and fuller carcasses.

3. The effectiveness of the use of complex mineralized premixes to improve the intensity of growth and development of young cattle

In Ukraine, the population of beef cattle is small, so beef is obtained from dairy cattle, mainly culled heifers, steers and culled cows [29]. In Ukraine, most livestock enterprises specialize in the development of the dairy industry.

[29] Bown M. D., Muir P. D., Thomson B. C. Dairy and beef breed effects on beef yield, beef quality and profitability: a review. *New zealand journal of agricultural research.* 2016. № 59. P. 174-184.

Therefore, it is currently impossible to increase beef production exclusively due to the intensive development of beef cattle in the direction of productivity. More than 95% of beef in the country is obtained from dairy and combined cattle.

In the farms of our country, among the dairy breeds of cattle, the Ukrainian black and spotted dairy breed is the most concentrated. The fattening young have good meat indicators and at the age of 12 months reach a live weight of 380-400 kg, at the age of 18 months – 500-520 kg.

Studies report that intensively reared dairy cattle can produce no less heavy carcasses and high-quality meat than beef cattle[30, 31, 32, 33]. In this regard, studies on the meat qualities of bulls of modern dairy breeds in the conditions of the region with certain fodder conditions and developed dairy farming are relevant. Effective development of animal husbandry is possible only with rational use of available fodder in each farm. However, the vast majority of plant feeds do not provide the animals' need for the most important microelements for obtaining high meat productivity indicators, which are important factors for ensuring complete nutrition. The source of nutrients for animals in an easily digestible form are feed additives that can compensate for the lack of nutrients in the diet.

To conduct the research, the task was set to substantiate the use of a corrective mineralized protein-vitamin supplement at the expense of deficient microelements in physiological needs to better ensure the level of realization of the genetic potential of animals for the intensity of growth and development.

Rational rearing of young animals should be based on the effective use of biological laws of animal development, in particular calves up to 6 months of age, because during this period skeletal muscles and axial skeleton grow more intensively, tissues and organs change, body functions are formed and improved.

To study the dynamics of growth and development of young animals up to 6 months of age, two groups of bulls of the Ukrainian black and spotted dairy breed were formed, 10 heads in each, according to the principle of pairs-analogs, taking into account breed, age and live weight. The change in the live weight of steers

[30] Ткачук В.П. Порівняльна оцінка росту та розвитку молодняку поліської м'ясної породи. *Таврійський науковий вісник.* 2019. № 109. Ч. 2. С. 135-140.

[31] Yaremchuk O.S., Razanova O.P., Skoromna O.I., Chudak R.A., Holubenko T.L., Kravchenko O.O. Post-slaughter indicators of meat productivity and chemical composition of the muscular tissues of bulls receiving corrective diet with proteinvitamin premix. *Regulatory Mechanisms in Biosystems*. 2022. № 13 (3).

[32]Bartoň L., Teslík V., Zahrádková R., Bureš D. Growth, feed efficiency and carcass characteristics of Czech Pied and Holstein bulls. *Czech Journal of Animal Science.* 2003. № 48. P. 459–465.

was studied by individual weighing when the animals were placed for the experiment and every month in the morning before feeding. Based on the results of the weighing, the absolute, average daily gain of live weight and the relative growth rate of the groups of test steers were determined.

The general level of feeding is established on the basis of detailed norms, taking into account the live weight, the planned productivity of bulls. The amount of feed eaten was determined every decade, during two adjacent days, by weighing feed and leftovers. In feeding young cattle when growing meat, the most important period is the milk period. The drinking schemes of experimental bulls were made based on the calculation of feeding one head for 6 months in the control group – 300 kg of whole milk, in the experimental group – 80 kg of whole and 220 diluted substitute of whole milk. From the age of 11 days, the experimental calves were gradually transferred to drinking whole milk substitute, and by the age of 20 days they completely switched to this feed. Dry whole milk substitute was diluted in warm boiled water immediately before drinking. In terms of nutrition, 1 kg of dissolved whole milk substitute corresponded to 1 kg of whole milk. In the same period, the calves of the experimental group were also given the protein-mineral-vitamin supplement Intermix calf as part of the grain part of the diet in the amount of 30%. Premixes are one of the most important elements of animal feeding, which allow to significantly increase the efficiency of production of livestock products, due to the fact that they are an enriching mixture of biologically active substances added to compound feed.

During the period of intensive rearing of calves with the inclusion of whole milk substitute and mineral premix in the rations in the first month, the live weight of the bulls increased by 1.6%, the absolute increase – by 4.0% compared to peers of the control group (table 7).

In the second and third months, a slight difference was found between the indicators of live weight and absolute growth of the control and experimental groups. Already in the fourth month, the advantage of the animals of the research group in terms of live weight was 2.2%, the absolute increase was 5.2%. At the end of the fifth month of cultivation, these indicators were 2.7 and 5.5%, respectively, in favor of the Bugai breeders, which were fed the Intermix protein-vitamin-mineral supplement. At the end of 6 months of rearing, the animals of the experimental group exceeded their counterparts in the control group by 3.4% in live weight, and by 8.4% in absolute growth.

Table 7

Intensity of growth of cattle during the dairy period, M±n, n=10

Age periods	Live weight, kg		Absolute growth, kg	
	1-control	2-experimental	1-control	2-experimental
At birth	33.5±1.04	33.5±1.84	-	-
1	55.8±0.64	56.7±1.24	22.3±0.24	23.2±0.17
2	81.1±0.91	82.4±1.18	25.3±0.18	25.7±0.24
3	107.5±2.11	109.2±2.87	26.4±0.36	26.8±0.19
4	128.6±2.46	131.4±2.18	21.1±0.29	22.2±0.26
5	150.3±3.33	154.3±2.37	21.7±0.18	22.9±0.34
6	171.7±2.56	177.5±1.34	21.4±0.22	23.2±0.17
7	193.3±3.24	199.7±2.11	21.6±0.42	22.2±0.24
8	213.4±2.81	223.9±1.56	20.1±0.34	24.2±0.18
9	239.5±1.97	251.5±2.03	26.1±0.28	27.6±0.12
10	266.2±2.04	282.8±1.65	26.7±0.14	31.3±0.25
11	293.1±1.92	311.6±2.33	26.9±0.18	28.8±0.14
12	322.4±2.43	342.5±2.42	29.3±0.20	30.9±0.26
13	353.2±1.87	374.0±1.37	30.8±0.25	31.5±0.22
14	382.0±2.35	405.1±2.03	28.8±0.12	31.1±0.17
15	410.3±2.07	439.1±2.24	28.3±0.11	28.8±0.10
During the period of the experiment			376.8±2.94	405.6±3.24

The research results showed that the average daily gains during the dairy period of growing calves were higher in the experimental group: in the first month – by 40 g, in the second and third – by 13 g, in the fourth – by 37 g, in the fifth – by 40, and in the sixth – by 60 g (Figure 1). Starting from the age of 7 months, the advantage of experimental bulls fed with the Intermix supplement was already more significant in terms of average daily growth. Thus, the difference in 7 months was 20 g, in 8 months – 136 g, in 9 months – 50 g, in 10 months – 153 g, 11 months. – 64 g, 12 months. – 24 g, 13 months. – 24 g and at 14 months – 76 g, 15 months – 17 g.

When putting the animals to the test, the live weight of the bulls was the same. Feeding whole milk replacer to calves instead of whole milk and mineral premix had a better effect on their growth and development, which positively affected the indicators in the following age periods. During the dairy growing period, higher absolute gains were obtained from bulls of the experimental group, exceeding peers from the control group by 5.8 kg, or by 4.5% (table 8).

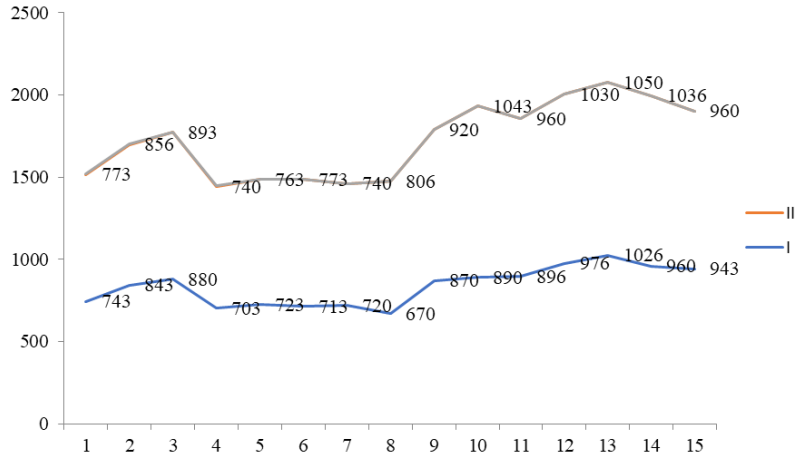

Fig. 1. The dynamics of average daily growth of cattle, g

During the period from 6 months to 12 months of age, the live weight of the Buhay children of the control group increased by 150.7 kg, and that of the experimental group by 165.1 kg, which is 9.6% higher than that of the control group. Over the next three months (12-15 months), the animals of the experimental group, which were fed a diet with the additive Intermix fattening, received 10.0% more absolute growth, compared to peers of the control group. and on average daily gains in live weight. During 6 months of rearing of bulls, 748 g of average daily gain in live weight was obtained, which is 32 g (4.4%) higher than the control peers. During the period from 6 to 12 months of age, the average daily gain was 902 g in the experimental group of animals against 823 g in the control group.

That is, the advantage was 79 g. From the age of one year to 15 months, the Buhay children of both groups had slightly higher growth rates. But feeding the mineral premix had a better effect on the results and in this group of animals 1050 g was obtained, in the control – 954 g (the difference was 96 g). During the entire period of fattening animals in the experimental group, the average daily gain of live weight was 928 g, in the control group – 860 g, which is 68 g less.

The greatest characteristic of animal growth is given by the relative growth rate. Thus, at the age of 6 months, the calves of the experimental group exceeded the control analogues by 16.6 pp, at the age of 12 months – by 3.6 pp, at the age of 15 months – by 3.3 pp.

Table 8

Indicators of growth intensity of bulls during the fattening period, M±n, n=10

Indicators	Groups	
	1-control	2-experimental
Live weight, kg: at the beginning of the experiment	42.8±1.21	42.8±1.06
in 6 months	171.7±2.56	177.5±1.34
in 12 months	322.4±2.43	342.5±2.42
in 15 months	410.3±2.07	439.1±2.24
Absolute growth, kg		
in 6 months	128.9±2.47	134.7±1.47
in 12 months	150.7±3.25	165.1±2.86
in 15 months	87.8±1.71	96.6±2.45
Average gain per day, g		
in 6 months	716	748
in 12 months	823	902
in 15 months	954	1050
За 1-15 місяців	860	928
Relative growth rate, %		
in 6 months	120.3	122.3
in 12 months	61.2	63.5
in 15 months	23.9	24.7

Thus, feeding bulls during the milking period with whole milk substitute, which did not differ from whole milk in terms of productivity, and Intermix calf mineral premix in their diet ensured intensive growth of experimental animals and this, accordingly, contributed to the reduction of feed costs per 1 kg of growth. Further feeding of mineral premix Intermix fattening in subsequent periods of fattening stimulated the organism of animals to more intensive growth and, accordingly, higher indicators were obtained in terms of average daily growth and live weight gain at the end of fattening. The next stage of the study was the determination of the multiplicity of increase in live weight of animals. Multiplicity of increase in live weight was determined by dividing live weight at 6-, 12-, and 18-months of age by the live weight of newborn animals.

There was a difference in the frequency of increase in live weight between the animals of the studied groups, and this indicator increased with age in both groups. Its variability depending on the level of feeding was in the range of 4.3–13.1. When calculating the multiplicity of increase in live weight of fattening steers, it was found that the animals of the experimental group had

slightly higher indicators during the entire period of the experiment, starting from the age of 6 months (Figure 2).

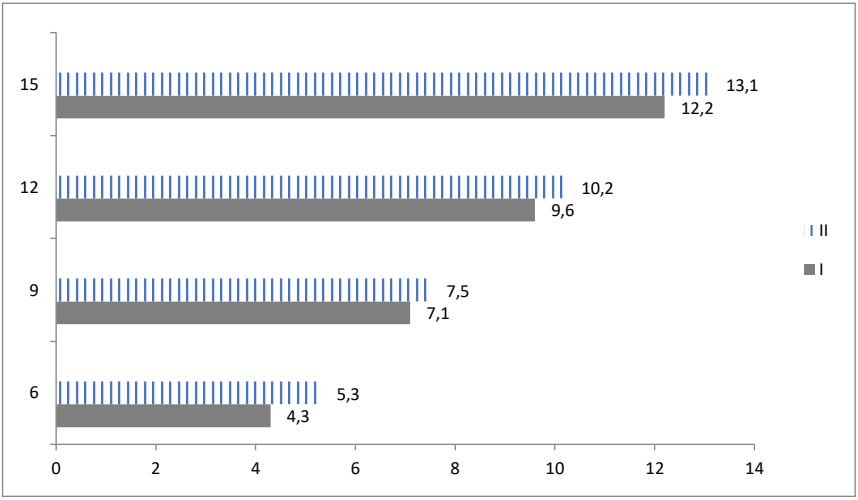

Fig. 2. Multiplicity of increase in live weight of fattening steers

In particular, the advantage was 23.2% at 6 months of age, 5.6% at 9 months, 6.3% at 12 months, and 7.4% at 15 months.

Thus, according to the conducted studies of important vital signs of meat productivity of experimental animals, namely: their live weight, absolute and average daily growth, it was found that the introduction of the studied supplement Intermix calf and Intermix fattening into the main diet had a positive effect on the studied indicators. At the same time, bulls of the experimental group prevailed in the entire set of analyzed traits. The body structure of farm animals is of great importance in determining their productivity. The evaluation of the exterior by measurements is of particular importance, because it is possible to analyze the animal's development at any period of its life, and is an important component in a complex breeding system. The main value of the exterior assessment is to get an idea of the constitutional strength, health of the body, its compliance with the conditions of keeping and in connection with the meat productivity. Taking linear measurements and calculating indices was carried out according to generally accepted zootechnical formulas. To characterize the linear growth, exterior, and general development of the animals, data from zootechnical records were used, and the following measurements were taken using a measuring stick, compass, and tape: height at the withers, height at the back, height at the sacrum, chest depth, chest width, girth chest behind the shoulder blades,

oblique length of the body (stick), width at the hips (hips), wrist circumference. Body structure indices of animals were calculated by the ratio of individual measurements.

The values of the body measurements of the newborn young were at the same level and without significant exterior differences between the groups. Later, starting from the age of three months, the bulls of the experimental group, unlike the control counterparts, were characterized by larger body diameters (table 9).

Table 9

Age-related changes in the linear diameters of calves from birth to 6 months, sm

Take measurements	Groups					
	control			experimental		
	Age of animals					
	at birth	3 mon.	6 mon.	at birth	3 mon.	6 mon.
Height at the withers	71.7	83.6	94.0	72.0	80.4	90.4
Height at the withers	75.5	87.8	99.5	77.3	85.2	94.7
Oblique length of the body	61.0	84.6	103.4	60.6	81.6	99.6
Chest depth	25.8	36.5	42.7	26.0	35.1	40.9
Chest width	16.8	23.8	30.0	17.2	27.3	34.2
Chest girth	78.4	87.6	110.4	77.6	91.0	113.6
Wrist girth	12.0	12.7	13.3	12.2	13.4	14.0
Width in maclocks	17.5	24.9	30.0	17.1	27.4	32.6

At the age of 3 months, the advantage in the experimental group was 3.5 cm in chest width, 3.4 cm in chest girth; 0.7 cm – by the girth of the wrist and 2.5 cm – by the width in the maklocks. At the end of the dairy growing period, at the age of 6 months, the difference between the indicated indicators in favor of the experimental group was as follows: 4.2 cm, 3.2 cm, 0.7 cm and 2.6 cm, respectively.

Bulls raised on a diet with mineral premix Intermix Calf had lower height measurements. Thus, the oblique length of the trunk in the animals of the experimental group is 3.0 cm less, the height at the sacrum is 2.6 cm, the height at the withers is 3.2 cm, and the depth of the chest is 1.4 cm. By the end of the suckling period (6 months) the advantage of bulls of the control group compared to the experimental group was 3.8 cm, respectively; 6.9 cm, 3.6 cm and 1.8 cm. Therefore, when feeding steers with the Intermix supplement, a more intensive growth of latitudinal measurements than of height measurements was observed. The exterior profiles of steers are shown at the age of 6 months after the end of the

suckling period in order to visualize the effect of the Intermix premix on the exterior features of the animals (Figure 3).

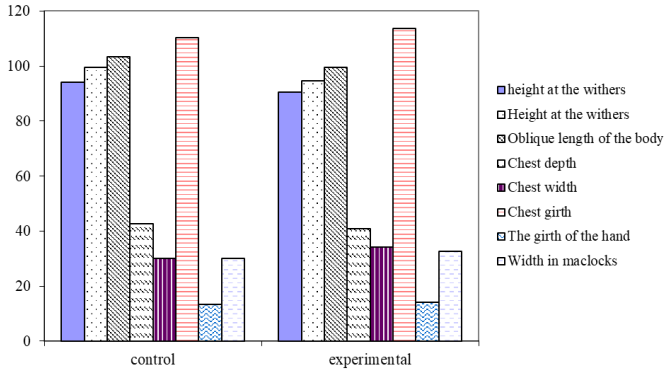

Fig. 3. Exterior profiles of linear measurements of bulls at the age of 6 months

The presented diagrams show the advantage of test group steers over control analogues in terms of body measurements, which are characteristic of the greater development of young beef cattle, namely, chest width, chest girth behind the shoulder blades, width at the withers and girth of the wrist.

During the next 9 months of the experiment (6-15 months), the steers that received the Intermix fattening protein-vitamin-mineral premix as part of their diet grew more intensively and their live weight increased, and an increase in the diameters of the external sexes of the experimental animals was observed (table 10).

The indicators of the measurements of the animals indicate that in the studied groups they practically did not differ from each other until the age of 6 months, but at the age of one year there was an advantage of the experimental group over the control group, which surpassed their counterparts in larger sizes, slightly elongated, proportionally developed trunks, deep in width chest, broad back, stronger bones. The bulls of the experimental group, which received the studied supplement, differed from the bulls of the control group by body type. Meat forms were better expressed in bulls of this group.

The study of the measurements of the body structure of the bulls of the experimental groups at the end of 12 months of age showed that the animals of the experimental groups showed the greatest intensity of growth in measurements compared to the control, in terms of height at the sacrum by 1.9%, depth of the chest by 3.08%, width of the chest by shoulder blades – by 3.5%, chest girth – by 1.8%.

Table 10

Body measurements in bulls at 12 months of age, centimeters, M±n, n=5

Indicators	Groups	
	control	experimental
Height at the withers	115.1±0.94	115.9±2.11
Height at the withers	120.8±0.73	123.1±1.95
Oblique length of the body	131.7±1.12	132.4±2.08
Chest girth	160.2±1.28	163.2±2.43
Chest depth	58.4±0.34	60.2±0.68
The width of the chest behind the shoulder blades	42.8±0.18	44.3±0.87
Width in maclocks	39.7±0.26	40.3±0.24
Wrist girth	17.0±0.17	17.2±0.21

In addition, according to such parameters as: width in maklocks, oblique length of the trunk, the advantage was given to bulls of the experimental group (Figure 4).

The relationship between the external forms of the body structure and performance indicators of animals is especially revealed when using the index evaluation of the exterior. The use of body structure indices makes it possible to objectively determine the development of individual sexes, their age variability and productive-typical differences, to distinguish types of body structure and to determine their relationship with the direction and level of productivity of animals in certain economic conditions.

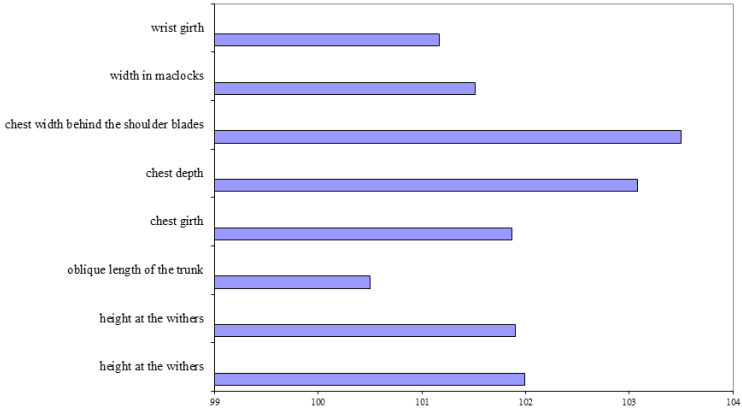

Fig. 4. Exterior profile of Bugai dogs of the research group at 12 months of age (indicators of the control group are taken as 100%)

With the help of animal index indicators, it is easier to notice the ratio of anatomically related body measurements of experimental animals. We studied the parameters of the physique index of bulls of experimental groups aged 12 months (table 11).

Table 11

Indexes of body structure of bulls at 12 months of age, %, M±n, n=5

Indicator	Group	
	control	experimental
Stretch marks	114.4±3.22	114.2±3.14
Long-legged	48.9±1.01	48.0±0.73
Pelvic-thoracic	107.8±1.95	109.9±3.06
Pectoral	73.2±1.47	73.5±1.02
Beaten up	121.4±3.48	123.3±3.43
Overgrowth	104.9±3.02	106.2±2.88
Bony bones	14.7±0.51	14.8±0.27
Massiveness	139.1±2.90	140.8±3.51

The obtained data indicate that the animals of the experimental group had a higher body composition index. Thus, they had higher indices such as thoracic, pelvic-thoracic, knockdown, overgrowth and massiveness than the control, which correspond to the body structure of animals raised for meat. According to the indicator of the index of sloppiness by 1.9%, massiveness – by 1.7%, pelvic-thoracic – by 2.1%.

4. Post-slaughter indicators of meat productivity and chemical composition of muscle tissue of cattle fed protein-vitamin premix

The main indicators of the meat qualities of animals are the mass of the carcass and its morphological composition. In order to study the meat productivity and meat quality of the test steers, a control slaughter was carried out after the end of the experience (15 months). Heavy, well-muscled carcasses were obtained from the bulls, which were assigned to the first category. To carry out the chemical composition of beef, samples were taken in the region of 9-12 ribs of half-carcasses and examined according to generally accepted methods[34]:

– total moisture content – by the method of drying meat to a constant mass in a drying cabinet at a temperature 100-105^{0}C;

– fat content – by the Soxhlet method, when fat is extracted from meat with ethyl ether followed by its distillation and drying of the fat;

[34] Лабораторні методи досліджень у біології, тваринництві та ветеринарній медицині : Довідник / В.В. Влізло, Р.С. Федорук, І.Б. Ратич, та ін.. Львів: СПОЛОМ, 2012. 764 с.

– protein content – by the Kjeldahl method, based on total nitrogen (nitrogen x 6.25);

– ash content – burning of a meat sample in a muffle furnace at a temperature of 400-450 0C; The energy value of beef was determined mathematically, using data on the amount of dry matter, ash and fat. The caloric content of meat was determined based on the data of chemical analysis according to the formula: K = [C – (Ж + 3)] x 41 + Ж x 93, where K is the caloric content of meat, kcal/kg; C – dry matter, %; F – fat, %; C – ash, %; 41 – calorie content of 10 g of protein, kcal (1% of kg); 93 – calorie content of 10 g of fat, kcal (1% of kg). Tasting evaluation of meat and broth from a sample of the longest muscle of the back was carried out on a 5-point scale. Meat was evaluated according to indicators of aroma, taste, tenderness and juiciness. The broth was evaluated based on its appearance, color, aroma, and taste. The results of the slaughter of experimental bulls showed that the best slaughter qualities were characterized by the bulls of the experimental group, which received the mineralized protein-vitamin supplement Intermix as part of the diet. More complete carcasses were obtained from them and, accordingly, during deboning, more edible parts of the carcass were obtained. In this group of animals, compared to the control, a higher slaughter yield (by 2.6%) and carcass yield (by 2.4%) was obtained, but the reliability of the increase was not confirmed (table 12).

Feeding bulls a diet with the studied additive Intermix fattening affected the nature of growth and development of muscles and bones, the intensity of fat deposition, which led to changes in the morphological composition of carcasses and the ratio of their individual parts. In the experimental group of steers, a greater mass of pulp was obtained by 10.8% ($p<0.05$) and, accordingly, a higher yield of pulp by 3.4 pp. ($p<0.001$).

Table 11

Slaughter rates of cattle for feeding protein-vitamin premix Intermix fattening, M±n, n=5

Indicator	Groups	
	control	experimental
Slaughter yield, %	55.9 ± 0.5	57.4 ± 0.27
Weight of the steamed carcass, kg	224.1 ± 5.6	245.6 ± 6.0*
Carcass yield, %	54.4 ± 0.5	55.7 ± 0.25
Mass of pulp, kg	171.4 ± 4.8	189.9 ± 3.8*
Pulp yield, %	76.92 ± 0.35	79.54 ± 0.23***
Bone yield, %	18.34 ± 0.36	17.46 ± 0.30
Yield of tendons and cartilage, %	3.89 ± 0.17	2.99 ± 0.18**
Coefficient of fleshiness	3.50 ± 0.08	3.89 ± 0.05*
Pulp output per 100 kg of live weight, kg	41.89 ± 0.55	42.93±1.0

A slightly smaller yield of bones was obtained in the carcasses of the Bugai animals of the research group – by 4.8 pp, tendons and cartilage – by 23.1 pp. It should be noted that an increase in the fleshiness coefficient by 11.1% ($p<0.01$) was found in the group of experimental Bugai cattle. The yield of pulp per 100 kg of pre-slaughter weight in the experimental group is 2.5% higher. Meat quality is determined by morphological and histological structure, chemical composition, and physical properties. The study of the chemical composition is fundamental when evaluating meat. For the comprehensive assessment of meat, taking into account its quality indicators, important importance is attached to the study of the chemical composition of the longest muscle of the back, taking into account that its average sample includes not only muscles, but also intermuscular fat. In the muscle tissue of cattle fed Intermix, a higher content of dry matter by 0.78% ($p<0.05$) and protein – by 0.85% ($p<0.05$) was found compared to similar indicators of the control group (table 13).

Table 13

Chemical composition and caloric content of the longest back muscle of Bugai cattle at 15 months of age, M±n, n=5

Indicator	Group	
	Control	Experimental
Dry matter, %	24.00 ± 0.14	24.78 ± 0.23*
Protein, %	20.58 ± 0.16	21.43 ± 0.20*
Fat, %	2.462 ± 0.053	2.330 ± 0.031
Ash, %	0.964 ± 0.021	1.018 ± 0.018
Calorie content, kcal	1072 ± 6	1095 ± 10

The reliability of the decrease in the fat content in the beef of the experimental group (by 0.13%) and the increase in ash by 0.05% was not established. A higher content of fat in the flesh of the carcass of bulls of the experimental group led to a decrease in the moisture content, and a lower content of fat in the flesh of the carcass of peers of the control group led to an increase in the water content. Analysis of samples of the longest back muscle of experimental steers showed that the ratio of moisture to dry matter was favorable and was 3.03:3.17. The quality of meat is also evaluated by the ratio of protein and fat in it. In experimental bulls, the ratio was 8.3:1–9.2:1. In the samples of the experimental group, the indicated indicator was slightly higher (9.2:1). The ratio of moisture and fat in the flesh of carcasses characterizes the maturity of the meat. At the age of 15 months, the index of 32.3% was obtained from steers that received a protein-vitamin premix as part of the diet, and 30.9% in the control group. This testifies to the fact that the studied supplement contributes to a greater synthesis of fat in the body of cattle. The

different content of protein and fat in the flesh of bull carcasses affected their higher energy value. The longest back muscle in the experimental bulls of the groups was distinguished by a higher energy value – by 23 kcal, or by 2.1%. Therefore, the mineralized protein-vitamin premix Intermix for fattening when fed to cattle in conditions of mineral deficiency of microelements in the forage of the diet contributes to the activation of metabolic processes, which contributed to the increase of post-slaughter indicators of meat productivity, improvement of the morphological composition and quality of the carcass. 15-month-old young animals fed the premix diet surpassed their peers in terms of slaughter weight by 9.8% ($p<0.05$) and carcass weight by 9.5% ($p<0.01$). In terms of fleshiness, there was an advantage in the group of Bugai cattle fed with the supplement: the fleshiness index was higher by 11.1% ($p<0.05$), the pulp of a higher grade was obtained – by 27.3% ($p<0.001$), the first variety – by 11.5% ($p<0.01$) more. In the muscle tissue of the longest muscle of the back of cattle, which consumed the Intermix supplement in the diet, the content of dry matter was higher by 0.78% ($p<0.05$), protein – by 0.85% ($p<0.05$). During the tasting evaluation of meat and broth, it was found that beef from young animals of the research group had better indicators compared to the meat of peers from other groups (table 14).

According to the indicators of aroma, taste, tenderness and juiciness of the meat, no significant intergroup differences were found.

Table 14

Tasting evaluation of beef after feeding Intermix supplement

Indicator	Boiled meat		Bouillon	
	Group			
	control	experimental	control	experimental
Appearance	3.45±0.26	3.73±0.18	3.98±0.09	3.77±0.11
Aroma	3.38±0.22	3.03±0.13	3.87±0.13	3.80±0.13
Taste	3.76±0.14	3.40±0.16	4.06±0.12	3.94±0.10
Tenderness	3.14±0.13	2.87±0.12	-	-
Succulence	3.33±0.16	2.94±0.14	-	-
Gpa	3.41±0.18	3.17±0.12	3.97±0.18	3.84±0.14

Due to the increase in the live weight of the experimental group, the indicators for the aroma, taste, juiciness and tenderness of the meat decreased slightly, as well as slightly lower scores obtained for the evaluation of the broth according to appearance, aroma and taste.

CONCLUSIONS

1. The productivity of fattening young cattle is most affected by balanced feeding, which is based on the needs of animals in various types of nutrients, vitamins, and mineral elements.

2. With the concentrated type of feeding and the introduction of trace elemental salts, Aberdeen Angus were characterized by more intensive growth and had the highest average daily gains – 1510 g with an advantage over Limousin breed analogues of 5.3%, Simmentals – 14.6%. The highest slaughter yield was obtained from bulls of the Aberdeen-Angus breed (60.3%), which is 4.6% more than Limousins, and 5.1% more than Simmentals. Under the same conditions of intensive cultivation, bulls of this breed are characterized by heavier and fuller carcasses. The yield of pulp in the carcasses of the Aberdeen-Angus breed was 79.7%, which is more compared to Limousins by 0.4%, and to Simmentals – by 0.7%. The weight of half-carcasses of first-class Aberdeen-Angus bulls was 2.2% higher than that of Limousin, and 7.9% of Simmental.

3. Feeding bulls during the milking period whole milk substitute and mineral premix Intermix calf in their diet ensured more intensive growth of experimental animals and this, accordingly, contributed to the reduction of feed costs per 1 kg of growth. At the end of the 6-month breeding period, bulls fed with the mineral premix Intermix outperformed the control counterparts by 3.4% in live weight, and by 8.4% in absolute growth. Further feeding of mineral premix Intermix fattening in subsequent periods of fattening stimulated the organism of animals to more intensive growth and, accordingly, higher indicators were obtained in terms of average daily growth and live weight gain at the end of fattening. The calves of the experimental group, which were fed the mineral premix Intermix, exceeded the control analogues by 16.6 pp, the 12-month-old – by 3.6 pp, and the 15-month-old – by 3.3 pp. The bulls of the research group had a more intense growth in latitudinal diameters than in height.

4. Feeding bulls a ration with the researched additive Intermix fattening resulted in obtaining a greater mass of pulp by 10.8% and, accordingly, a higher yield of pulp by 3.4 p.p. an increase in the fleshiness coefficient by 11.1% ($p<0.01$) was found in the group of experimental cattle. A higher content of dry matter, protein and ash was found in the muscle tissue of cattle fed Intermix.

SUMMARY

The economic crisis, which led to the decline of domestic agricultural production, caused a sharp deterioration in the conditions for feeding and keeping cattle. Therefore, it is necessary to choose such a system of management of the relevant branch of animal husbandry, which would

correspond to the direction of the expected productivity in order to obtain the maximum amount of high-quality and healthy products from a sanitary point of view. Achieving high productivity of animals is possible only under the condition of adequate feeding and strengthening of the fodder base. Measures to eliminate the deficiency of trace elements should be based on the study not only of the characteristics of biogeochemical zones, but also of individual farms. The optimal concentration of trace elements in body tissues depends on their content in diets and the biological availability of each of them. Considering this, there was a need to find and develop new methods of improving the productivity of animals and the quality of their products in fattening cattle, taking into account the economic characteristics and biogeochemical zones of the region. In view of the above-mentioned reasons, the widespread use of trace elements, vitamins, enzyme preparations and other biologically active substances in the practice of animal husbandry in order to increase the productivity of animals is becoming more and more relevant. Under the concentrated type of feeding and the introduction of trace elemental salts, Aberdeen Angus were characterized by more intensive growth and had heavier and fuller carcasses. Feeding bulls with mineral premix Intermix ration ensured more intensive growth of experimental animals and this, accordingly, contributed to the reduction of feed costs per 1 kg of growth. mineralized protein-vitamin premix Intermix for feeding cattle in conditions of mineral deficiency of microelements in the feed ration promotes the activation of metabolic processes, which contributed to the increase of post-slaughter indicators of meat productivity, improvement of the morphological composition and quality of the carcass.

Bibliography

1. Aydin R., Yanar M., Diler A., Kocyigit R., Tuzemen N. Effects of different slaughter ages on the fattening performance, slaughter and carcass traits of brown Swiss and Holstein Friesian young bulls. *Indian Journal of Animal Research.* 2013. № 47 (1). P. 10-16.

2. Bartoň L., Teslík V., Zahrádková R., Bureš D. Growth, feed efficiency and carcass characteristics of Czech Pied and Holstein bulls. *Czech Journal of Animal Science.* 2003. № 48. P. 459–465.

3. Bown M. D., Muir P. D., Thomson B. C. Dairy and beef breed effects on beef yield, beef quality and profitability: a review. *New zealand journal of agricultural research.* 2016. № 59. P. 174-184. https://doi.org/10.1080/00288233.2016.1144621

4. Budde A. M., Sellins K., Lloyd K. E., Wagner J. J., Heldt J. S., Spears J. W., Engle T. E. Effect of zinc source and concentration and chromium supplementation on performance and carcass characteristics in feedlot steers 1,2,3. *Journal of Animal Science.* 2019. Vol. 97. № 3. P. 1286-1295. DOI: 10.1093/jas/skz016.

5. Cooke R. F., DiLorenzo N., Di Costanzo A., Yelich J. V., Arthington J. D. Effects of Fermenten (R) supplementation to beef cattle. *Animal feed science and technology*. 2009. Vol. 150. № 3-4. P. 163-174. DOI: 10.1016/j.anifeedsci.2008.08.011.

6. Даньків В.Я., Постол О.І., Зінкевич В.І., Венгрін Я.Д. Вплив згодовування білково-жиро-мінеральної добавки телятам у молочний період на гематологічні показники та активність ферментів в крові. *Сільський господар.* 2012. № 9-10. С. 22-24.

7. Денькович Б.С., Півторак Ю.І., Гордійчук Н. М. Вирощування племінних теличок за використання концентрату «Інтермікс-теля 30%». *Науковий вісник Львівського національного університету ветеринарної медицини та біотехнологій імені С. З. Ґжицького. Серія: Сільськогосподарські науки.* 2017. Вип. 19. № 74. С. 147-151. DOI:10.15421/nvlvet7433.

8. Довгаль О.В. Розвиток м'ясопродуктового підкомплексу АПК України. *Економічний простір.* 2020. № 164. С. 31–37. DOI: https://doi.org/10.32782/2224-6282/164-5.

9. Довгій Ю.Ю., Котелевич В.А., Сеніченко В.Ю. Вплив вітамінно– мінеральних комплексів на морфологічні і біохімічні показники крові телят. *Збірник наукових праць.* Болгарія, Софія. 2019. С. 22–29. 10. 10.

10. Фаріонік Т. В. Вплив хелатних сполук (метіонатів) на морфологічний склад туш та дегустаційну оцінку м'яса отриманого від тварин чорно-рябої м'ясної породи. *Науковий вісник Львівського національного університету ветеринарної медицини та біотехнологій імені С. З. Ґжицького.* 2015. Вип. 17. № 3. С. 423-426.

11. Федючка М., Молярчук П., Світельський М., Ревунець А. Вплив мінеральних добавок на ріст і розвиток молодняку ВРХ. *Тваринництво України.* 2010. № 11. С. 32–34.

12. Фурманець Ю.С. М'ясна продуктивність бичків абердин-ангуської породи при згодовуванні у складі комбікормів цеолітових туфів. *Науковий вісник Львівського національного університету ветеринарної медицини та біотехнологій імені С.З. Ґжицького*. 2010. Т. 12. № 2 (44). Ч. 3. С. 250-2 54.

13. Girard I., Aalhus J., Basarab L., Larsen I. L., Bruce H.L. Modification of beef quality through steer age at slaughter, breed cross and growth promotants. *Canadian Journal of Animal Science*. 2012. Vol. 92. P. 75–188. DOI: 10.4141/cjas2012-001.

14. Glombowsky P., da Silva A.S., Soldá N.M. Mineralization in newborn calves contributes to health, improve the antioxidant system and reduces bacterial infections. *Microbial Pathogenesis.* 2018. Vol. 114. P. 344-349. doi: 10.1016/j.micpath.2017.12.012

15. Гончарук А. П. БВМД «Інтермікс» у раціонах відгодівельних свиней. *Науковий вісник Львівського національного університету*

ветеринарної медицини та біотехнологій імені С. З. Ґжицького. 2016. Вип. 18. № 67. С. 52–57.

16. Gorlov I. F., Trukhachev V. I., Randelin A. V., Slozhenkina M. I., Shlykov S. N. Forming the quality indicators to beef by feed additives «Yoddar-Zn» and «Glimalask-Vet». *Research Journal of Pharmaceutical, Biological and Chemical Sciences.* 2016. Vol. 7. № 3. P. 2323.

17. Грибан В. Г., Милостіва Д. Ф. Забійні якості та хімічний склад яловичини для збагачення раціону мікроелементами. *Науковий вісник Львівського національного університету ветеринарної медицини та біотехнологій імені С. З. Ґжицького.* 2014. Вип. 60. № 4. С. 45-49.

18. Ібатуллін І.І., Мельничук Д.О., Богданов Г.О. та ін. Годівля сільськогосподарських тварин. В.: Нова Книга, 2007. 616 с.

19. Кандиба В.М., Ібатуллін І.І., Костенко В.І. Теорія і практика нормованої годівлі великої рогатої худоби : монографія. 2012. 860 с.

20. Казьмірук Л.В., Калинка А. К. Вирощування бугайців планових порід та їх помісей з використанням різних технологій утримання та годівлі у молочному періоді в умовах регіону Буковини. *Аграрна наука та харчові технології.* 2019. Вип. 5 (108). Т. 1. С. 66-75.

21. Kincaid R. L. Assessment of trace mineral status of ruminants: a review. *Journal of Animal* Science. 1999. Vol. 77. № 1. P. 1–10. DOI:10.2134/jas2000.77E-Suppl:1-10.

22. Крук О. М'ясність телят української чорно-рябої молочної породи різного віку. *Тваринництво України*. 2015. № 5. С. 26-30.

23. 23. Мазуренко М. О., Гуцол А. В., Єфимчук С. М. Вплив годування БВМД Інтермікс на продуктивність телят. *Науковий вісник Львівського національного університету ветеринарної медицини та біотехнологій імені С.З. Ґжицького.* 2015. Т. 17. № 61. С. 109-113.

24. McCarthy L., Underdahl S. R., Dahlen C. R. Effects of a vitamin and mineral bolus on beef heifer feedlot performance, feeding behavior, carcass characteristics, and liver mineral concentrations. *Transl Anim Sci.* 2020. Vol. 13. № 4(2). P. txaa027. DOI: 10.1093/tas/txaa027.

25. Міхур Н.І. М'ясна продуктивність відгодівельних бугайців та якісні показники яловичини за різної структури раціонів. *Науковий вісник Львівського національного університету ветеринарної медицини та біотехнологій імені С.З. Ґжицького*. 2015. Т. 17. № 1(61). С. 128-134.

26. Moriel P., Arthington J. D. Effects of trace mineral-fortified, limit-fed preweaning supplements on performance of pre– and postweaned beef calves. *Journal of Animal Science.* 2013. Vol. 91. P. 1371-80. DOI: 10.2527/jas.2012-5469.

27. Muller A., Burren A., Jorg H. Identifying ideal beef and dairy crossbreeds to optimise slaughter yields. *Agrarforschung schweiz*. 2015. Vol. 6. № 1. P. 28-35.

28. Niedermayer E. K., Genther-Schroeder O. N., Loy D.D., Hansen S. L. Effect of varying trace mineral supplementation of steers with or without hormone implants on growth and carcass characteristics. *Journal*

of Animal Science. 2018. Vol. 3. № 96. P. 1159-1170. DOI: 10.1093/jas/skx063.

29. Nogalski Z., Pogorzelska-Przybyłek P., Sobczuk-Szul M., Purwin C., Modzelewska-Kapituła M. Effects of rearing system and feeding intensity on the fattening performance and slaughter value of young crossbred bulls. *Annals of Animal Science.* 2018. Vol. 18. P. 835–847. DOI:10.2478/aoas-2018-0022.

30. Orikhivskyi T. V., Fedorovych V. V., Mazur N. P., Pirlog A. Dynamics of early growth of heifers of simmental breeds of different production types. *Scientific and Technical Bulletin of State Scientific Research Control Institute of Veterinary Medical Products and Fodder Additives and Institute of Animal Biology.* 2019. Vol. 20. № 2. P. 366-374. https://doi.org/10.36359/scivp.2019-20-2.48

31. Poberezhets J., Chudak R., Kupchuk I., Yaropud V., Rutkevych V. Effect of probiotic supplement on nutrient digestibility and production traits on broiler chicken. *Agraarteadus.* 2021. Vol. 32 (2). P. 7. DOI: 10.15159/jas.21.28.

32. Прилипко Т.М., Захарчук, П.Б. Показники продуктів забою бичків залежно від селеновмісних добавок у раціоні. *Біоресурси і природокористування.* 2019. Т. 11. № 1-2. С. 146-155. DOI: 10.31548/bio2019.01.016.

33. Razanova O. P. Increasing meat quality quails fed by biological active additives based on submerged bees. *Ukrainian Journal of Ecology.* 2018. Vol. 8. № 1. P. 631-636. DOI: 10.15421/2017_259.

34. Разанова О.П., Скоромна О.І., Яремчук О.С., Побережець Ю.М. Інтенсивність росту бичків молочного періоду за впливу добавки Інтермікс. *Таврійський науковий вісник. Серія: Сільськогосподарські науки.* 2022. Вип. 125. С. 176-184. DOI: 10.32851/2226-0099.2022.125.25.

35. Разанова О.П., Яремчук О.С., Гутий Б.В., Новгородська Н.В., Фаріонік Т.В. Вплив БВМД Інтермікс на живу масу та лінійні проміри бичків української чорно-рябої молочної породи. *Вісник Сумського національного аграрного університету. Серія: Тваринництво.* 2022. Вип. 1 (48). С. 65-71. DOI: 10.32845/bsnau.lvst.2022.1.10.

36. Sawant P. Effect of Supplementation of Minerals and Vitamins on Growth Performance of Indigenous Heifers. *Indian Journal* of *Animal Nutrition*. 2013. Vol. 30. Vol. 4 . P. 387-391.

37. Schaefer A. L., Stanley R. W., Tong A. K.W., Dubeski P., Robinson B., Aalhus J. L., Robertson W.M. The impact of antemortem nutrition in beef cattle on carcass yield and quality grade. *Canadian journal of animal science.* 2006. Vol. 86. P. 317-323.

38. Сегеда С.А. Статистичний аналіз споживання м'яса та м'ясопродуктів в Україні. *Міжнародний науково-виробничий Журнал «Економіка АПК»*. 2020. № 3. С. 36–46. DOI: https://doi.org/10.32317/2221-1055.202003036

39. Сеніченко В.Ю. Економічна ефективність використання «Живини» у годівлі телят. Органічне виробництво і продовольча безпека. Житомир, 2018. С. 558–561.

40. Шкурин Г.Т., Тимченко О.Г., Вдовиченко Ю.В. Забійні якості великої рогатої худоби: методики досліджень. К. : Аграрна наука, 2002. 50 с.

41. Скоромна О.І., Гордій А.М., Голембівський С.О., Разанова О.П., Вікарчук Н. Ефективність розведення кросів бельгійської блакитної породи великої рогатої худоби в Україні. *Таврійський науковий вісник. Серія: Сільськогосподарські науки.* 2022. Вип. 125. С. 184-193. DOI: 10.32851/2226-0099.2022.125.26

42. Syrovatko K. M., Vuhliar V. S. The effect of additives with essential oils on the productivity of young pigs. *Regulatory Mechanisms in Biosystems*. 2021. Vol. 12. № 1. P. 92-95. DOI: 10.15421/022114.

43. Tagirov H. H., Gubaidullin N. M., Fakhretdinov I. R., Khaziahmetov F. S., Avzalov R. K., Mironova I. V., Iskhakov R. S., Zubairova L. A., Khabirov A. F., Gizatova N. V. Carcass quality and yield attributes of bull calves fed on fodder concentrate. *Journal of Engineering and Applied Sciences.* 2018. Vol. 13. № 8. P. 6597–6603. DOI: 10.36478/jeasci.2018.6597.6603.

44. Ткачук В.П. Порівняльна оцінка росту та розвитку молодняку поліської м'ясної породи. *Таврійський науковий вісник.* 2019. № 109. Ч. 2. С. 135-140. DOI https://doi.org/10.32851/2226-0099.2019.109-2.21

45. Цуп В.І., Тихонова Б.Є., Федорович В.С. Використання ехінацеї пурпурової у складі мінеральновітамінного премікса при вирощуванні телят. *Науковий вісник Львівського національного університету ветеринарної медицини та біотехнологій імені С.З. Гжицького*. 2015. Вип. 17. № 3. С. 337-342.

46. Лабораторні методи досліджень у біології, тваринництві та ветеринарній медицині : Довідник / В.В. Влізло, Р.С. Федорук, І.Б. Ратич, О.І. Віщур, М.М. Шаран, І.В. Вудмаска, Є.І. Федорович, Д.Д. Остапів, П.В. Стапай, О.М. Бучко, А.В. Гунчак, Ю.Т. Салига, О.М. Стефанишин, І.І. Гевкан, Я.В. Лесик, М.Р. Сімонов, І.В. Невоструєва, М.М. Хомин, К.Б. Смолянінов, В.В. Гавриляк, Г.В. Колісник, І.М. Петрух, Н.А. Брода, І.В. Лучка, І.І. Ковальчук, С.Й. Кропивка, Н.М. Параняк, В.М. Ткачук, М.І. Храбко, О.В. Штапенко, Є.О. Дзень, І.Я. Максимович, В.В. Федорович, Л. Л. Юськів, О.П. Долайчук, Л.А. Іваницька, Я.М. Сірко, В.О. Кисців, О.В. Загребельний, Р.П. Сімонов, Г.М. Стояновська, Б.Я. Кирилів, М.І. Кузів, Х.Я. Майор, Н.В. Кузьміна, Н.І. Талоха, Б.Б. Лісна, Д.О. Климишин, Т.В. Чокан, М.В. Камінська, М.Р. Козак, А.В. Олійник, Н.В. Голова, В.В. Дубінський, Р.Я. Іскра, Й.Ф. Рівіс, Н.Л. Цепко, В.І. Кишко, Н.П. Олексюк, Г.Г. Денис, Ю.І. Сливчук, Ю.В. Мартин; за ред. В.В. Влізла. Львів: СПОЛОМ, 2012. 764 с.

47. Yaremchuk O.S., Farionik T.V. Effect of chelate compounds of microelements on the organism of agricultural animals. *Modern engineering*

and innovative technologies. 2022. Vol. 23. Part 1. P. 99-115. DOI: 10.30890/2567-5273.2022-23-01-029

48. Яремчук О. С., Фаріонік Т. В., Разанова О. П., Скоромна О. І., Ушаков В. М. Наукові підходи обгрунтування щодо використання мікроелементних хелатних сполук за виробництва яловичини в умовах дефіциту мікроелементів : монографія. Вінниця: ТОВ «Друк», 2022. 196 с.

49. Yaremchuk O.S., Razanova O.P., Skoromna O.I., Chudak R.A., Holubenko T.L., Kravchenko O.O. Post-slaughter indicators of meat productivity and chemical composition of the muscular tissues of bulls receiving corrective diet with proteinvitamin premix. *Regulatory Mechanisms in Biosystems.* 2022. Vol. 13. № 3. P. 219-224. DOI:10.15421/022228

Information about the authors:

Razanova Olena Petrivna,
Candidate of Agricultural Sciences,
Associate Professor at the Department of Technology of Production,
Processing of Animal Husbandry and Feed Products
Vinnytsia National Agrarian University
3, Soniachna str., Vinnytsia, 21008, Ukraine

Farionik Taras Volodymyrovych,
Candidate of Veterinary Sciences
Associate Professor at the Department of Veterinary Hygiene,
Sanitation and Expertise
Vinnytsia National Agrarian University
3, Soniachna str., Vinnytsia, 21008, Ukraine

Skoromna Oksana Ivanivna,
Candidate of Agricultural Sciences,
Associate Professor at the Department of Technology of Production,
Processing of Animal Husbandry and Feed Products
Vinnytsia National Agrarian University
3, Soniachna str., Vinnytsia, 21008, Ukraine