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INFLUENCE OF DIFFERENT ENERGY-PROTEIN RATIOS OF DIETS ON THE PRODUCTIVITY OF REPAIR HEIFERS IN DIFFERENT CLIMATIC CONDITIONS

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The paper substantiates the need to improve the energy and protein nutrition of heifers in order to increase the efficiency of their cultivation taking into account climate changes. In scientific and economic experiments on heifers, the energy-protein feed additive TEP-mix was used, with a high degree of protection against the breakdown of protein (65.25 %) and starch in the rumen.

The main results of the conducted research indicate that improving the energy and protein balance in the body of heifers due to the use of TEP-mix supplements in their diets is a physiologically justified and cost-effective element of feeding technology. The use of diets with the inclusion of TEP-mix additives in their composition provides an increase in the amount of protected protein and starch in the general diet, which has a positive effect on increasing live weight gain and improving the economic efficiency of cultivation.

The results prove that even in conditions of reduced feed intake due to increased outdoor temperature, providing heifers with protein and energy is a reliable way to control their productivity during critical temperature conditions for raising animals.

The developed diets for feeding heifers with the inclusion of high-protein energy feed additive TEP-mix with an energy-protein ratio of 8.1:1 provided an increase in the level of non-split in the rumen, contributed to the stabilization of metabolic processes in the animal body and allowed to increase the average daily growth of heifers in the cold season by 7.7 % , and in the summer by 20.8 %. Changes in the protein diet of heifers in the direction of saturation of the diet with protein, which is digested according to the intestinal type from 28.05% to 34.83% provided better tolerance to heat stress. Moreover, with an increase in temperature to the maximum, the degree of counteraction to heat stress becomes the greatest.

With a 10% increase in the normal protein level in the second group, the energy-protein ratio increased to 9.7:1, and the level of protein that is not broken down in the rumen decreased to 26.59 %. Under these conditions, the average daily weight gain of heifers in winter decreased by 3.0%, in summer – by 6.2 %.

Keywords: heifers, energy-protein ratio, feed additive, live weight, air temperature.

ВПЛИВ РІЗНОГО ЕНЕРГО-ПРОТЕЇНОВОГО СПІВВІДНОШЕННЯ РАЦІОНІВ НА ПРОДУКТИВНІСТЬ РЕМОНТНИХ ТЕЛИЦЬ В РІЗНИХ КЛІМАТИЧНИХ УМОВАХ

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У роботі обґрунтовується необхідність удосконалення енерго-протеїнового живлення телиць для підвищення ефективності їх вирощування за урахування змін клімату. В науково-господарських дослідах на телицях використовувалася енерго-протеїнова кормова добавка ТЕП-мікс, з високим ступенем захищеності від розщеплення в рубці протеїну (65,25 %) і крохмалю.

Основні результати проведених досліджень свідчать, що покращення енергетичного та білкового балансу в організмі телиць за рахунок використання в їх раціонах добавки ТЕП-мікс є фізіологічно обґрунтованим та економічно вигідним елементом технології годівлі. Застосування раціонів із включенням до їх складу добавки ТЕП-мікс забезпечує збільшення кількості захищеного протеїну та крохмалю в загальному раціоні, що позитивно впливає на збільшення приросту живої маси та покращення економічної ефективності вирощування.

Отриманні результати доводять, що навіть за умов зниження споживання корму внаслідок збільшення температури зовнішнього повітря, забезпечення телиць білком та енергією є надійним способом керування їх продуктивністю в період критичних для вирощування тварин температурних умов.

Розроблені раціони годівлі телиць із включенням високобілкової енергетичної кормової добавки ТЕП-мікс з енерго-протеїновим співвідношенням 8,1:1 забезпечили зростання рівня нерозщеплюваного у рубці, сприяли стабілізації процесів обміну речовин в організмі тварин та дали змогу підвищити середньодобові прирости телиць у холодну пору року на 7,7 % , а у літній період на 20,8 %. Зміни білкового живлення телиць у напрямі насичення раціону протеїном, який перетравлюється за кишковим типом з 28,05 % до 34,83 % забезпечили кращу толерантність до дії теплового стресу. При чому, з підвищенням температури до максимуму, ступінь протидії тепловому стресу стає найбільшим.

За збільшення на 10 % від норми рівня протеїну в другій групі, енерго-протеїнове співвідношення збільшилося до 9,7:1, а рівень протеїну, що не розщеплюється в рубці, знизився до 26,59 %. За цих умов середньодобові прирости живої маси телиць в зимовий період знизилися на 3,0 %, у літній – на 6,2 %.

Ключові слова: телиці, енерго-протеїнове співвідношення, кормова добавка, жива маса, температура повітря.

In most modern protein nutrition systems, determining the need of animals for protein is based not on the content of raw and digestible protein in the diet, but on the amount of protein that is synthesized in the rumen and broken down in the small intestine. That is, the total need of ruminants for protein is defined as the sum of its cleaved and non-cleaved particles in the rumen. This approach to optimizing the protein nutrition of highly productive animals is based on providing their bodies with easily soluble nitrogen compounds of feed protein and non-protein sources of nitrogen, which is replenished by

proteolysis of microbial protein and feed protein (Rodríguez, R. et al, A., 2007; Wang, Y. et al, 2015; Lima, J. et al, 2023).

Modern studies of the processes of digestion and assimilation of feed nutrients, protein biosynthesis in the rumen have given a solid basis for adjusting the existing feeding standards and evaluating feed. Animal feeding standards that are recommended for practical use, published in special reference books, are considered indicative, since they need to be adjusted in accordance with the conditions of specific farms, depending on age, fatness, method of keeping animals and climate change (Kramarenko, O. S. 2024).

The synthesis of microbial protein in the pre – pancreas of cattle is limited in the range of 45-60% of their amino acid requirement, the remaining amino acids of animals should be obtained with non-split protein in the rumen (Galyean, M. L. et al, 2024; Harun, A. Y. et al, 2019). The problem is that when feeding feed, on the one hand, it is necessary to prevent excessive digestion of proteins and amino acids under the influence of microorganisms, and on the other – to achieve maximum synthesis of microbial protein and assimilation of non-protein forms of nitrogen. Unbalanced diets in terms of energy and protein nutritional value lead to an overspend of feed by 25-30 %, which worsens the economic performance of economic activity (Katongole, C. B. et al, 2020; Brown, E. G. et al, 2005).

Further development of dairy cattle breeding and increased productivity largely depend on the intensification of feed production, the organization of proper care and maintenance of livestock, the genotype and quality of reared repair heifers intended for reproduction. The future productivity of the herd and the profitability of the industry largely depend on how repair heifers are raised (Admin, O. Y. et al, 2024; Boulton, A. C. et al, 2017).

The relatively low intensity of herd renewal and the low level of feeding of repair heifers usually restrain the further growth of dairy productivity of cows. Poor feed quality, the level of feeding of young animals and premature disposal of animals from the herd are a deterrent to intensive herd recovery in many farms. There are also problems with the selection of heifers for reproduction, because during the period of their rearing, half of them are eliminated. One – and-a-half-year-old heifers with an insufficiently balanced feeding diet have a live weight of only 290-300 kg, and in some places even less. To get a heifer with a live weight of 370 kg by the time of fertilization, it takes 26-28 months, and offspring from them are received only at 35-37 months. As a result, the time frame for growing repair young animals is delayed for 9-10 months. The farm suffers double losses: it is impossible to get high productivity from such a cow, and the number of unproductive parts of the dairy herd increases unnecessarily. All this, in turn, leads to overspending of feed and the need to have additional premises and service personnel on the farm and negatively affects the economy of the industry. (Uhrincat, M. et al, 2021; Sharapa, G. S. et al, 2019)

Due to an unbalanced and insufficient level of feeding, the growth rate of animals decreases, and feed costs per unit of growth increase. During the cultivation of repair young animals, it is necessary to organize feeding in such a way as to obtain planned indicators of live weight gain, which will ensure from birth to 16-18 months of age their growth at the level of 750-850 G (Heinrichs, A. J. et al, 2011; Handcock, R. C. et al, 2019; Hawkins, A. et al, 2020).

Analysis of feeds used in animal feeding shows that their diets are mostly deficient in protein, sugar, starch, phosphorus, sulfur, magnesium, copper, zinc, cobalt, and iodine. To avoid this deficiency, especially in terms of protein, carbohydrates, minerals and vitamins, various feed additives are widely used in the diets of repair young animals during rearing (Hurlbert et al, 2024; Menezes, A. C. B. et al, 2022). But, as the analysis

of feeding proves, most feed additives that are manufactured in industrial conditions and used in feeding practice do not meet the regulatory requirements for nutritional value and mineral composition. In this regard, there is an urgent need to organize the production of new feed additives and determine their impact on the usefulness of diets during the period of rearing young animals from birth to 13-15 months of age.

A significant number of studies have shown that cattle exposed to heat stress have a negative nitrogen balance due to reduced feed intake (Wang, J. et al, 2020; Meneses, J. A. M. et al, 2021), which can be offset by an increase in protein content in the diet, but this can lead to an excess of nitrogen and a negative nitrogen balance in the rumen. Therefore, if the dry matter intake of the diet decreases during heat stress, then there is a need to increase the protein and energy concentration in the dry matter of the diet (Singh, et al, 2021, Chang-Fung-Martel, J. et al, 2021). At the same time, it is necessary to take into account the quality of protein, the amount of metabolic energy in the diet and the energy-protein ratio, which can significantly affect the efficiency of converting nitrogenous compounds in the ruminant body into products (Kim, W. S., et al, 2022)

There is an urgent need for additional research to determine the effectiveness of using protein of different quality and quantity in conditions of climate change and improve protein nutrition of repair young animals to increase the intensity of their growth and, as a result, increase future milk productivity. This is the relevance of conducting research.

The aim of the research is to determine the optimal energy – protein ratio in the diets of heifers and its effect on productive characteristics and adaptive ability.

Materials and methods of research. When conducting the research, bibliographic (formation of an introduction), zootechnical (selection of groups, Organization of experiments, drawing up rations, assessment of feed consumption, measurement of body and air temperature, calculation of respiratory rate and pulse, weighing heifers), physico-chemical (determination of the content of basic nutrients in feed), biochemical (determination of the biochemical composition of blood), statistical (calculation of probability), mathematical (calculation of economic efficiency) methods were used.

To achieve this goal, LLC "Pechenezhskoe" of the Chuguevsky District of the Kharkiv region conducted a scientific and economic experiment. for its organization, taking into account the breed, age, live weight and health status, 3 groups of heifers of the Ukrainian red-pock dairy breed were formed, 8 heads each, which were selected using the method of par-analogs.

When justifying the research scheme, we proceeded from the following position: I group of experimental heifers was defined as control, and II; and III – as experimental (table.1). In the control and second groups, a traditional supplement with a low degree of protein protection against cleavage in the rumen was used (15.2%), and in the third group – with a high degree of protected protein (65.3 %). This made it possible to obtain a different ratio of protein and energy in the research groups.

Table 1

Scheme of scientific and economic experience

Group	Characteristics of diets	The ratio of digested protein to energy
And control	Basic diet (BD)	8,6
II experimental	BD + additive with sunflower cake	9,7
III experimental	BD + protein supplement TEP-mix	8,1

So in the diets of heifers of the second group, the energy-protein ratio was 9.7, which is higher than normal, and in animals of the third Group, 8.1, which is lower than normal. With almost the same level of feeding of experimental heifers, which was 2.27 – 2.35 kg of dry matter of the diet per 100 kg of live weight, the level of energy-protein ratio reached from 3.14 to 3.75.

The experiment was performed using the Group – period method. The air temperature was measured with an alcohol thermometer with a scale ranging from -50 to +50 °C and a division price of 1 °C, twice a day, followed by calculation of the average daily and average monthly temperature. The thermometer was placed in a place protected from direct sunlight, at a height of 2 meters from the floor.

At the beginning of each period, the chemical composition and nutritional value of the selected feed samples were determined in the laboratory for evaluating and monitoring the quality of livestock products and feed of the Livestock farming institute of NAAS. During the experiment, the feed samples were determined: primary moisture-by drying the feed sample at a temperature of 60-65 °C; dry matter – by drying the sample at a temperature of 100 °C for 6 hours; crude protein – by K'eldahl micrometer; energy available for exchange – by calculation. All chemical analyses were performed using parallel definitions in the same samples, and the data were considered working only when the indicators of parallel studies did not exceed the permissible errors.

To conduct the experiment, full-fledged feed mixtures were made, which were distributed twice a day. The main diet consisted of corn silage, triticale haylage + oats, alfalfa hay, corn and barley turf (table. 2). During the experiment, attention was paid to optimizing the level and amount of protein that is not cleaved and broken down in the rumen, which significantly affects the productivity of animals.

Table 2

Feeding ration of heifers

Composition of the feed mixture	Group		
	I	II	III
Corn silage, kg	6,0	6,0	6,0
Haylage triticale + oats, kg	3,0	3,0	3,0
Yucernovoe hay, kg	1,5	1,5	1,5
Corn turf, kg	0,4	0,4	0,6
Barley turf, kg	0,7	0,35	0,4
Sunflower cake, kg	0,4	0,75	-
TEP mix, kg	-	-	0,3
The diet contained:			
DOE, MJ	60,7	60,3	59,1
Dry matter, kg	6,05	6,06	5,86
Crude protein, g	790,3	872,2	745,6
Digestible protein, g	521,6	584,7	480,3

Before providing a new batch of feed, the leftovers that were weighed were completely removed from the feeder. The difference between the specified amount of feed and the mass of residues was used to determine their actual consumption. At the same time, the collection and weighing of feed residues was carried out for each group separately.

The safety of experimental supplements for the body of experimental heifers was concluded on the basis of changes in clinical and physiological parameters and general

condition. Observations were carried out at the beginning and end of the first and third periods, twice a day: in the morning at 6 o'clock and in the evening at 18 o'clock. The pulse rate was determined by palpation of the caudal artery in the area of the 3rd and 4th caudal vertebrae, the respiratory rate was determined visually by the movements of the abdominal wall by counting the number of respiratory movements per minute, and the body temperature was determined by rectal thermometry.

Blood samples for biochemical studies were taken from the jugular vein in three heifers from each group, two hours before morning feeding. Total protein, albumins, globulins, total cholesterol, aspartateaminotransferase (AST), and alanylaminotransferase (ALT) were determined in serum on a BS 3000-m biochemical analyzer.

Live weight was determined by monthly individual weighing of animals in the morning before feeding. Based on weighting, the total increase for a certain period and the average daily increase in live weight were calculated.

The calculation of economic efficiency was carried out on the basis of taking into account the actual amount and cost of feed consumed, as well as the received products (growth).

Research results. The body's response to climate changes and feeding conditions depends on the perfection of adaptation mechanisms, which are a complex complex involving all organs and systems. To a large extent, the adaptability of animals to climate change conditions can be inferred from such indicators as respiratory rate, pulse and body temperature. The body temperature of the experimental heifers during the experiment was within the physiological norm (38.0–38.5 °C). The lowest variability was characterized by the value of body temperature, for which a clear intergroup difference was not established. In winter, the body temperature of heifers from morning to evening was almost at the same level, while in summer it decreased by 0.1 and 0.2 °C. This indicates a certain dependence of the body temperature of heifers on the ambient temperature.

The experiment, which lasted 185 days, consisted of three periods, each of which was characterized by a different outdoor temperature due to the change of seasons. The average air temperature in the winter period of the experiment (63 days) was at +1 °C, with fluctuations from -10 °C to +5 °C, spring – (61 days) – +21 °C, with fluctuations from +10 °C to +24 °C, summer (61 days) – +28 °C, with fluctuations from +24 °C to +36 °C.

Heifers of all groups in the summer period were characterized by the highest indicators of respiratory rate and pulse, and in winter they noticeably decreased. These changes can be explained by a significant difference in air temperature both directly inside the storage room and outside it. Analysis of the data obtained shows that the season of the year has the greatest impact on the respiratory rate. At the same time, in summer, the animals had an average of 2.3 and 6.5 respiratory movements more than in winter, respectively. The pulse rate was somewhat more stable.

Taking into account the chemical composition and nutritional value of the feed, the feeding rations of experimental animals were calculated. All rations were calculated according to feeding standards, and ensured that the productivity of heifers was obtained at the level of 700 – 800 g of the average daily weight gain.

The diet of the first group of heifers consisted of a mixture of 6.0 kg of corn silage, 3.0 kg of triticale haylage+oats, 1.5 kg of alfalfa hay, 0.4 kg of corn turf, 0.7 kg of barley turf and 0.4 kg of sunflower cake. It contained 6.05 kg of dry matter, 60.7 MJ of metabolic energy, 790 g of crude protein, and 521 g of digestible protein.

The composition of the feed mixture of the second group of heifers included 6.0 kg of corn silage, 3.0 kg of triticale haylage+oats, 1.5 kg of alfalfa hay, 0.4 kg of corn turf, 0.35 kg of barley turf and 0.75 kg of sunflower cake. Its nutritional value was 6.06

kg of dry matter, 60.3 MJ of metabolic energy, 872 g of crude protein, 584 g of digestible protein.

The diet of the third group of heifers included 6.0 kg of corn silage, 3.0 kg of triticale haylage+oats, 1.5 kg of alfalfa hay, 0.6 kg of corn turf, 0.4 kg of barley turf and 0.3 kg of TEP mix. It contained 5.86 kg of dry matter, 59.1 MJ of metabolic energy, 740 g of crude protein, and 480 g of digestible protein.

It was found that in the control group of animals with an energy-protein ratio of 8.6, the level of cleaved and non – cleaved protein in crude protein was 72% and 28 %, in the second group, where this ratio was 9.7, the level of crude protein was 13.25% against 12.1% in the control, the ratio of cleaved and non-cleaved protein was different-73.4% and 26.6 %. In the third group of animals, where the high-energy protein supplement TEP-mix was used, the level of energy – protein ratio was lower and amounted to 8.1, and the ratio of protein fractions – 65.2% and 34.8%, respectively, for 11.5% - crude protein.

It was found that when the air temperature increased, the consumption of diets by experimental heifers slightly decreased. When the air temperature outside is -2 °C in the winter period of the experiment, the consumption of the feed mixture was in the range of 11.8-12.0 kg/day. An increase in temperature leads to a decrease in feed consumption and generally negatively affects the productivity of animals. So, at an outdoor temperature of +24 °C in the summer period of the experiment, the consumption of feed mixture was in the range of 11.4–11.6 kg/day.

As a result of biochemical blood tests, it was established that the replacement of cake with TEP-mix in the diets of Group III heifers had a positive effect on metabolism and contributed to the stabilization of the values of the main biochemical parameters of blood, which were within the physiological norm (table. 3). Heifers in the third group had a higher total protein score of 1.08 and 0.53 g/L compared to the first and second groups. However, heifers of the second group who received a diet with EPS of 9.7 g/MJ showed increased alanine aminotransferase activity, compared with animals of the first and third groups by 3.18 u/l and 1.98 u/l, respectively, regardless of changes in ambient temperature.

Table 3

Biochemical composition of heifers ' blood

Group	Total Protein, g/l	Albumins, g/l	Globulins, g/l	Total cholesterol, mmol/l	AST, u/l	ALT, u/l
I	73,22±2,24	37,19±0,38	36,03±0,28	3,41±0,36	80,50±3,16	27,34±1,11
II	73,77±0,94	35,04±0,87	38,73±0,28	3,63±0,27	81,45±3,18	30,52±0,98
III	74,30±0,43	35,33±0,84	38,97±0,42	3,77±0,24	82,53±2,11	28,54±0,79

One of the main indicators of the effectiveness of using heifer feeding diets in the experiment is the change in their productivity under the influence of different energy-protein ratios in the diets. In fact, the obtained indicators of productivity of experimental animals indicate that in Winter (63 days), heifers of all groups increased their body weight by an average of 45.3 – 50.2 kg, while the average daily increase in live weight was on average 719 – 797 g. that is, the experimental animals adequately corresponded to the planned level of feeding and the amount of specified nutrients that entered their body. However, the differences in the performance of heifers who received different feed additives are obvious. In particular, with almost the same intake of nutrients in the body of heifers of the second group, but with an increase in the energy-protein ratio above the

norm, the increase in winter was the smallest. An increase in the amount of protein broken down in the rumen did not affect the level of average daily live weight gain in Group II heifers. At the same time, a decrease in the amount of protein in the diet of heifers of the third group and a shift in the energy-protein ratio to a smaller side led, on the contrary, to an increase in the growth intensity of heifers relative to the control and the second group.

When the outdoor temperature ranged from -10 °C to +5 °C, the inclusion of the feed additive TEP-mix in the diets of heifers provided higher growth intensity indicators than in animals of the first and second groups. Heifers of all groups increased their live weight by 46.8±1.68, 45.3±2.00 and 50.3±2.17 kg during the winter period.

In the spring period of the experiment, when the average ambient temperature was +21 °C, heifers increased their live body weight by 44.3±1.50 kg, 42.8±1.46 and 48.6±2.33 kg, respectively, by groups. The average daily increments were at the level of 725±25.54 g, 701±23.94 g and 797±38.18 g. that is, compared with the first stage, we can say that with an increase in ambient temperature, the productivity of animals within the groups changed slightly.

As for the effect of changes in ambient temperature on the productivity of heifers, a similar trend was observed in the summer period. During the summer period of the study, when the ambient temperature rose to +36.4 ° C, and feed consumption decreased by 3-5 %, live weight gain was obtained in all groups for the period at the level of 34.5±1.25, 32.4±1.91 and 41.8±2.09 kg ($p<0.01$), respectively. Consequently, an increase in the ambient temperature to critical leads to a decrease in feed consumption, deterioration of comfortable conditions for keeping animals and a decrease in their productivity.

According to the scientific and economic experiment, in different seasons of the year, results were obtained that indicate that for the use of protein feed additives in the diets of experimental animals, which provide a different energy-protein ratio, you can get both excellent indicators of live weight gain of heifers, and the level of production cost and profit. The use of high-protein supplements in diets allowed the experiment to have the cost of a daily diet at the level of 36.44–37.98 UAH in the winter period, while this indicator was observed in the third group, where the feed additive TEP-mix was used, due to its high cost. But, as further calculation proved, higher indicators of the growth intensity of heifers caused not only the lowest cost of 1 kg of growth, but also the profit received, which was the highest in this group. Thus, the cost of 1 kg of growth in animals of the third group was UAH 47.66, which is less than the corresponding indicator in the first group by UAH 1.50 and UAH 4.03 in the second. The amount of profit in heifers of the third group for the winter period also exceeded the peers of the first and second groups. In the spring period, heifers of the third group had a lower cost price than their peers by 2.51-5.43 UAH, the profit is higher – respectively. The same trend in economic indicators was observed in the summer period.

Thus, the use of a feeding diet, in which the amount of non-split protein was higher and the energy-protein ratio was 8.1:1, allowed us to obtain large increases in live weight of heifers and better economic indicators, which is more likely due to the better assimilation of the fraction of non-split protein in the rumen, both in the warm and cold seasons.

Discussion. Climate change leads to an increase in the average annual surface temperature of the Earth and is inextricably linked with animal husbandry. It is known that a sharp increase in temperature and humidity can directly or indirectly affect the physiology and productivity of animals (Wang, J. et al, 2020; Meneses, J. A. M. et al, 2021). In the context of global climate change, as well as the growing cost of energy carriers, agricultural machinery, feed and additives, etc., repair young animals are a

special concern of the farm, which characterizes the past and present, as well as determines its future. The future productivity of the herd and the profitability of the industry largely depend on how repair heifers are raised (Admin, O. Y. et al, 2024; Boulton, A. C. et al, 2017). Therefore, there is a need for additional research to determine the effectiveness of using different quality and quantity of feed protein in conditions of changing climatic conditions and improving protein nutrition of repair young animals to increase the intensity of its growth and, as a result, increase future dairy productivity.

The analysis of information sources covers a wide range of issues related to the production and use of protein supplements for young cattle (Hurlbert et al, 2024; Menezes, A. C. B. et al, 2022).

The results obtained proved the need to improve energy and protein nutrition for repair young cattle, which will allow us to obtain more significant indicators of increasing the intensity of its growth, taking into account climate changes.

The interest of dairy producers in raising healthy repair young animals in the context of global warming is gaining more and more momentum. On the one hand, the cultivation of repair young animals to the right age and weight is affected not only by the quantity, but also by the quality of components of the feeding diet, especially protein. Using cheap and low-quality feeds that are poor in energy content and with a low level of protein that is not cleaved in the rumen, it is impossible to obtain high-quality young animals with a high potential for dairy productivity in the future. Such production is not competitive and has low profitability. On the other hand, when raising heifers, you need to take into account the annual increase in air temperature, especially in the summer. The correct selection of feed for the feeding diet is the key not only to raising healthy heifers, but also to obtaining high milk productivity and productive longevity in the future.

Concluding the review on the use of feed additives with soybean meal as a priority feed crop in the conditions of climate change, it should be noted that climate change will continue to affect many areas in agriculture, and therefore the selection of feed and feed additives that reduce the impact of negative climatic factors on the body of young cattle, while increasing the productivity of animals, becomes particularly relevant.

Conclusions.

1. The inclusion of the TEP-mix feed additive in the diets of heifers made it possible to optimize the ratio of energy and protein up to 8.1:1, but did not affect the clinical and physiological parameters of heifers that were within the normal range.

2. The use of high-energy protein feed sources that regulate the level of non-cleaved protein in the diet can be considered as a factor in preventing heat stress and increasing the intensity of animal growth in ontogenesis, including under critical conditions of elevated temperatures.

3. It was found that when the air temperature increased above +30 °C, heifers who received diets with the addition of TEP-mix had a higher growth rate at the level of 41.8±2.09 kg ($p<0.01$) with low nutrient consumption per 1 kg of live weight gain.

4. The he value of biochemical parameters (total protein, albumin, globulin, total cholesterol, ALT, AST) in the blood serum of animals of all groups was at the level of reference values. However, heifers of the second group who received a diet with EPR of 9.7 g/MJ showed increased alanineaminotransferase activity compared to Animals of the first and third groups by 3.18 u/l and 1.98 u/l, respectively, regardless of changes in ambient temperature.

5. The introduction of the promising TEP-mix protein supplement to diets helps to increase the economic efficiency of raising heifers by increasing the net profit per head in different seasons of the year.

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