Nitrogen balance in energy-carbohydrate-fed cows

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Abstract. Enriching the diet of cows with nutrients and energy is an urgent task facing livestock specialists. In this regard, we propose to use a new type of feed in the diet of cows. For this purpose, using the software package, a ration balance was made for cows of black and motley breed. The differences were that different doses of the new “Tanrem” energy-carbohydrate feed were administered to the cows of the experimental groups. When analyzing the structure of the diet, it was found that in the pasture period a significant proportion falls on succulent feed, and in the stall - on rough and concentrated. It should be noted that both in the grazing and stalling periods, cows show a decrease in the proportion of succulent feeds with the introduction of the studied additive. Calculation of nitrogen balance showed that in all animals participating in the experiment, it was positive. In this case, nitrogen was best used from the accepted and from the digested cow of the three experimental groups, worst of all - control animals. The maximum effect was shown by the supplement at a dose of 700 g per day per animal. Further research will focus on the study of milk productivity and the quality of dairy products of cows.

1. Introduction

The energy supply of feed intended for feeding farm animals is one of the main factors determining the level of their productivity [1–6].

In order to form a more complete and clear picture of the nutritional value of a particular feed, it is necessary to evaluate it in terms of the amount of digestible nutrients contained [2–8].

Currently, livestock specialists are searching for new sources of enrichment of the feed ration of cows in order to increase milk production. This is important from an economic point of view, since it allows to reduce the cost of production, as well as the organization of non-waste production [7–15].

We propose enriching the diet of cows with the “Tanrem” energy-carbohydrate feed, which is characterized by the presence of fibers of structural fiber that improves the motility of the rumen or stomach. The attractive chocolate flavor and aroma of the feed causes animal appetite, providing better...
eatability and assimilation of the entire feed ration. The components of the studied feed belong to natural prebiotics and energy, providing activation of metabolic processes [5, 6].

The state of protein metabolism should be assessed, since it is involved in all the vital functions of the body. Under the influence of enzymes of the digestive system of animals, feed protein is prone to cleavage into polypeptides and amino acids and their absorption in the blood. Nitrogen acts as a limiting element of animal feed consumed and is part of the organic matter of any product. In this case, the nitrogen balance is necessary to determine the amount of feed protein used, the increase or decrease in the proportion of protein in the body of the animal. Depending on the physiological state of the animal and the level of feeding, the daily balance of nitrogen in the animal’s body can be positive, negative, and zero [7–10].

Balancing the diet for all nutrients is a rather long and laborious process, so it is advisable to use computer programs [11–19].

In connection with the foregoing, of scientific and practical interest is the study of the nitrogen balance in lactating cows when different doses of energy-carbohydrate feed are included in the diet.

Intensively introduced new technologies for feeding and keeping farm animals and poultry can improve the need for nutrients and energy [1–6].

The relevance of the chosen direction is confirmed by the fact that the research was carried out in accordance with the thematic plan of research work No. state. reg. 01201058950 “Development and improvement of livestock production technologies” and a certificate of state registration of a computer program.

2. Material and methods
The experiment lasted from 2019 to 2020. The balancing of cow rations was carried out with the “Tanrem” energy-carbohydrate feed in different dosages (250, 500 and 700 g per animal per day). The feed in the calculated amount was mixed with the grain mixture and fed for two feedings: in the morning and in the middle of the day.

As a result, animals were divided into 4 groups: control and three experimental. Control animals were given feed exclusively prepared on the farm, and experimental animals (groups 1, 2, and 3) were enriched with the study drug. Diet balancing was carried out in a program designed for calculating the nutritional value of the diet, planning of harvesting and consumption of feed for different periods of their maintenance.

To analyze the flow rate of metabolic processes and objectivity in the assessment, the data of physiological experience served as the basis for calculating the nitrogen balance. The calculation was carried out in the program "Program complex for calculating the nitrogen balance for cattle" developed by the authors. The program is designed to carry out calculations to determine the balance of nitrogen, taking into account its consumption with feed and its excretion in urine, feces, milk. It consists of the following modules: calculation of the average nitrogen content in feed, urine, feces and milk, calculation of the nitrogen balance in the rumen. The first module provides a statistical calculation of average indicators, the average error and the coefficient of variation of the trait. The average data obtained during the initial calculation is entered by the user into the nitrogen balance calculation module. During the calculations, the program can display a positive, neutral or negative nitrogen balance, as well as the amount of nitrogen used for the production of products expressed as a percentage.

During the balance experiment, the mass of fed feed, its residues, as well as urine, feces and milk were taken into account. Selected samples for canning. The results of chemical analysis of feed, milk, urine and feces served as the basis for calculating the average daily nitrogen balance.

3. Results
The diet of cows of black-motley breed for grazing and stall keeping is presented in table 1. Analysis of the diet indicates that regardless of the group, in its structure, the proportion of succulent feed in the pasture period occupies from 80.35 to 86.86%, concentrated from 12.15 to 13.14%; and in the stall - the share of roughage is from 35.02 to 37.37%, succulent - from 24.30 to 25.93% and concentrated from
34.39 to 36.70%. It should be noted that both in the grazing and stalling periods, cows show a decrease in the proportion of succulent feeds with the introduction of the studied additive.

**Table 1.** The composition of the diets of cows per 1 animal, kg.

| Type of feed                                   | Period | pasture | stall |
|------------------------------------------------|--------|---------|-------|
| Grass bean-bean mixture                       |        | 58      | -     |
| Alfalfa haylage                               |        | -       | 12    |
| Barley straw                                  |        | -       | 3     |
| Corn silo                                     |        | -       | 20    |
| Molasses feed                                 |        | -       | 1     |
| Barley                                        |        | 0.5     | 2.4   |
| Oats                                          |        | 1.1     | 2.5   |
| Peas                                          |        | 1.3     | 0.4   |
| Salt, g / kg                                  |        | 0.1     | 0.1   |
| Monosodium phosphate feed, g / kg             |        | 0.15    | 0.13  |
| Premix P60-1                                  |        | -       | 0.055 |
| Additive “Tanrem” I (control) / II / III / IV |        | - 0.25  | 0.50  | 0.75 |

The diet of cows was analyzed for the average daily nitrogen balance, which is important because it allows a comparative assessment of the processes of protein metabolism in animals, depending on the different doses of energy-carbohydrate feed (table 2).

**Table 2.** Cow nitrogen balance, n = 3.

| Indicator                           | Group                        | Control 1 | 1 experienced | 2 experienced | 3 experienced |
|-------------------------------------|------------------------------|-----------|---------------|---------------|---------------|
| Taken with food, g                 |                              | 358.45±3.08| 367.36±3.16   | 374.91±2.45a | 381.40±2.40b |
| Highlighted: with feces, g         |                              | 121.52±0.62| 120.13±0.95   | 119.51±0.38  | 121.13±0.66  |
| with urine, g                      |                              | 136.47±0.58| 133.46±1.24   | 136.77±0.84  | 138.6±0.42   |
| with milk, g                       |                              | 107.43±1.17| 105.34±1.37   | 106.72±1.23  | 108.61±1.30  |
| Total allocated, g                 |                              | 354.37    | 358.99        | 362.98       | 368.20       |
| Overcooked, g                      |                              | 240.63    | 247.23        | 255.42       | 260.27       |
| Balance ±, g                       |                              | 4.08      | 8.37          | 11.93        | 13.20        |
| Nitrogen used,% of accepted        |                              | 30.22     | 30.97         | 31.65        | 31.94        |
| from digested,%                    |                              | 38.05     | 38.61         | 39.66        | 39.76        |
| Nitrogen used on products,% of accepted |                      | 29.08     | 28.69         | 28.47        | 28.48        |
| from digested,%                    |                              | 43.32     | 42.63         | 41.78        | 41.73        |

a = P<0.05
b = P<0.01

From the data of Table 2 it is seen that the cows of the experimental groups with food received more nitrogen than the control peers with a difference of 8.91 g (2.49%) compared with the 2nd group; Group 3 - at 16.46 g (4.59%; P≤0.05) and group 3 - at 22.95 g (6.40%; P≤0.01).

The cows of the control group allocated the largest mass of nitrogen with feces, which is 0.39–2.01 g (0.32–1.68%) in comparison with the experimental groups.

Analyzing the data of nitrogen digestibility, it was found that this indicator was higher in groups of
cows receiving a diet enriched with energy-carbohydrate components. So, in cows of the 1st experimental group, the mass of digested nitrogen was higher than in the control by 6.6 g (2.74%); 2 experimental - at 14.79 g (6.15%) and 3 experimental - at 19.64 g (8.16%).

It is important to note that the balance of nitrogen in the body of all animals participating in the experiment was positive. In dairy cows of the 3rd experimental group, in the diet, which included 700 g of energy-carbohydrate feed, there is an increase in nitrogen intake with the diet, which is probably due to the high consumption of feed components of the diet.

At the same time, the maximum percentage of nitrogen utilization from the adopted one was for cows of the 3rd experimental group, exceeding the control by 1.72%; peers of 1 experimental group - by 0.97% and 2 experimental - by 0.29%. A similar picture can be observed on the use of nitrogen from the digested. According to this indicator, in cows of the experimental groups, it increased by 0.56–1.71%.

The best indicators for the use of the nitrogenous part of the diets were demonstrated by cows of the 3 experimental groups consuming the tested type of feed at a dose of 700 g per day per animal.

4. Conclusion

Thus, the possibility of enriching the diet with energy-carbohydrate components is a very promising measure. This allows better use of the nitrogenous part of the diet. The best effect was achieved when using the additive “Tanrem” in a dose of 700 g per animal per day.

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