Impact of the Tirsana BSC energy supplement on the productivity of Ayrshire cows

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Abstract. Nowadays, a new science-based approach to animal feeding is required to create conditions for the full realization of their potential with intensive use of livestock. This research was an experimental test that aimed to evaluate effective feed intake of energy supplements TirsanaBSC by high-yield Ayrshire cows in the transit period. As a result of the supplement application the daily milk yield increased during 100 days of milking cows. The amount of milk fat and protein increased as well. There was an increase in carotene, glucose, pyruvic acid in the blood of experimental cows and reducing non-esterified fatty acids (NEFA). Adding the supplement Tirsana BSC to the diet of highly productive Ayrshire cows improved the quality of their colostrum.

1. Introduction
Increasing the productivity of farm animals is possible only if they are fully fed. This is available with the rational use of available feeds prepared in-house and proper balancing of diets in accordance with modern concepts of normalized feeding [1]. Special attention of specialists and scientists is paid to the conditions of rational feeding of farm animals, the development and implementation of innovative and new technologies in this area that is the basis for further development of animal husbandry [2].

A huge increase in the intensity of metabolism in highly productive cows creates a problem of discrepancy between actual energy consumption and its intake with feed at different stages of the physiological cycle. The higher cow productivity, the stronger the disparity is manifested, which affects the health of animals and causes loss of their productivity, reducing the duration of economic use [3].

The most critical time in feeding dairy cows is the period, which includes late dry one (3 weeks before calving), calving, and the beginning of lactation that follows. The late dry period should be considered as a favorable time to invest in future lactation: the better animals are prepared for calving, the fewer complications occur. Immediately after calving, the cow's body requires special support, since it works with a huge stress, spending more energy than it receives with feed [4]. In the last day before calving feed consumption falls, and immediately after it the need for energy increases sharply (up to 25-30%). In this case, it is necessary to solve the main task: to prepare digestive system to assimilate a large amount of feed after calving, that is, it is important to search for means and methods of introducing special additives into cow's diet [5].

2. Research materials and methods
We studied the efficiency of the Tirsana BSC energy supplement for highly productive Ayrshire cows in the transit period.
Scientific and economic experiment was carried out at the Maysky complex of Maysky integrated agricultural production company in the Vologda region. We used the method of groups, each of which had 13 animals, selected according to the analog principle, taking into account the generally accepted methodological recommendations [6]. Animals were formed into groups in accordance with age (1.3 lactation), productivity of previous lactation for 305 days (8770 kg), and physiological state. The scheme of scientific and economic experiment is presented in table 1.

| Group          | Number of cows | Feeding features                                      |
|----------------|----------------|-------------------------------------------------------|
| Control        | 13             | Basic diet                                            |
| ExperimentalI | 13             | Basic diet + Tirsana BSC for 30 days before and 60 days after calving |
| Experimental II| 13             | Basic diet + Tirsana BSC from calving to 90 days of lactation |

The objects of the research were the energy supplement «TirsanaBSC», groups of Ayrshire cows, colostrum and raw milk. The subjects of the research were the health state of animals in experimental groups, average daily milk production, daily milk yield of basic fat content, composition and properties of colostrum and raw milk. Standard methods of analysis were used to study the composition and properties of colostrum and raw milk.

To determine mass fractions of fat, protein and dry substances we applied the method of spectroscopy using a near-infrared Fourier spectrometer from Bruker (Germany)[7], the number of somatic cells determined with the Somatos Mini device[8].

Since the productivity of animals is high, the company uses glycerol in feeding cows during the milking period to prevent a lack of energy in their bodies. At the time of experiment, the animals of experimental groups were excluded from the diet with glycerol and instead introduced onto the studied energy supplement, Tirsana BSC.

According to the scheme of the experiment, over the 30 days prior to calving the cows in the control group were fed 100 g of glycerin (practice of the farming) and the cows from experimental group 1 were fed 300 g of supplement TirsanaBSC in addition to the basic diet, the cows from experimental group 2 received only the basic diet after calving. Animals received per meal daily: control group – glycerin (100 g), experimental 1 – energy supplement Tirsana BSC (300 g) within 60 days, and experimental 2 - energy supplement Tirsana BSC (300g) within 90 days of lactation. Distribution of additives was made in the morning, immediately after giving feed mixture. An individual measuring cup was used with each animal.

The feed additive TirsanaBSC is a source of energy for cows in the transit period. The product consists of highly efficient glycolytical drugs and BOVINE-S-COMPLEX that actively protects cow’s liver. The propylene glycol and glycerol complex has a pleasant taste, directly affects the synthesis of glucose, increases the blood sugar level of a highly productive cow. BOVINE-S-COMPLEX contributes to the lysine and methionine formation in rumen, which leads to reducing the content of ammonia in it. Thus stress on the liver is reduced, metabolism is activated and a large number of glucoplastic amino acids are formed.

3. Results of the study
The scientific and economic experiment aimed to carry out the monitoring of feed consumption in the stalls with dry cows and then during the first milking every 10 days. For this purpose, the feed given to cows and its leftover were weighed for two consecutive days. That allowed to determine the feed intake.
The best feed consumption during the late dry period and in the time of first milking was identified in the cows of experimental groups. Analyzing the nutritional value of experimental animals’ diets based on actual consumption, a slight improvement was noted in the supply of experimental cows with organic and mineral substances. Higher feed consumption and introduction of the studied supplement in a cow’s diet gives an opportunity to increase the average amount of metabolic energy in the experimental groups by 5-5.1%. This fact predetermined the increase in milk productivity. The research results are presented in Table 2.

**Table 2. Dairy productivity of cows (n=13)**

| Parameter | Group                |               |               |
|-----------|----------------------|---------------|---------------|
|           | control              | experimental 1| experimental 2|
| Average daily milk yield for 100 days, kg | 34.8±0.97   | 39.1±0.94**   | 39.4±1.03**   |
| % to control group | 100.0               | 112.4         | 113.2         |
| Fat content, % | 4.01±0.04   | 3.97±0.04     | 3.98±0.05     |
| % to control group | 100.0               | 99.0          | 99.3          |
| Daily milk yield with basic fat content, kg | 41.1±1.11   | 45.7±1.31**   | 45.9±1.35**   |
| % to control group | 100.0               | 111.2         | 111.7         |
| Protein content,% | 3.33±0.02   | 3.35±0.03     | 3.33±0.02     |
| % to control group | 100.0               | 100.6         | 100.0         |
| Daily production: |                   |               |               |
| milk fat, g | 1395.5±38.4 | 1552.3±44.5** | 1568.1±45.2** |
| milk protein, g | 1159.0±30.6 | 1309.8±35.0** | 1312.0±34.7** |

** P>0.99

Daily milk yields of the cows in experimental groups through the 100 days of feed distribution significantly exceeded the productivity of control animals by 12.4 and 13.2% (39.1 and 39.4 kg in comparison with 34.8). Protein and fat content in groups had almost no differences. However, the average milk fat amount from the cows in experimental group 1 exceeded by 11.2% the yield from animals in control group and by 12.4%that of the experimental group 2. The amount of milk protein obtained in experimental groups in comparison with the control one was higher by 13.0 - 13.2%.

The health of cows was monitored in according to their appearance, weight, clinical and biochemical indicators. Body temperature, pulse rate, number of respiratory movements, number of rumen contractions in five minutes were within the limits of physiological norms in all three groups.

The state of metabolism was estimated by 19 biochemical blood parameters. The metabolic profiles of cows during the study differed not much from the physiological standards. At the same time there were positive effects in different groups of the animals, whose diet included the Tirsana BSC energy supplement. Thus, increase of carotene, glucose, pyruvic acid in the cows' blood from experimental group 2and a decrease in unesterified fatty acids (UFA) were noted in the study.
Colostrum is a unique product that provides the creation of passive immunity in newborn calves due to immunoglobulin. It has a bactericidal effect due to lysozyme, inhibits development of pathogenic microorganisms due to high acidity and has a high nutritional value [9].

The colostrum taken from experimental animals was studied on the day of calving. The results obtained are presented in table 3.

Table 3. Quality of colostrum

| Parameters                        | Groups          |
|----------------------------------|-----------------|
|                                  | control | experimental 1 | experimental 2 |
| Density, kg/m³                   | 1.046±0.003 | 1.062±0.005 | 1.057±0.004 |
| Protein content, %               | 14.41±0.36   | 15.88±0.54 | 15.36±0.82 |
| Fat content, %                   | 5.87±0.36    | 5.16±0.47  | 4.77±0.29  |
| Solids not fat, %                | 18.63±0.36   | 20.1±0.51  | 19.54±0.80 |
| Somatic cells content, thousand/cm³ | 260.0±60.1 | 127.4±23.1 | 113.0±9.9 |

Newborn calves cannot produce antibodies in their organisms, and their intestines are not a barrier for microbes that easily enter the bloodstream from the air and when licking various objects. This fact can lead to diseases. The newborn's resistance to diseases, therefore, its growth and development, as well as obtaining high gains and raising animals with a good resistance to microorganisms depend mainly on the quality, quantity and timeliness of colostrum feeding.

There is a close and direct correlation between colostrum density and the level of immunoglobulin accumulation in it. Colostrum with the density of more than 1.060 kg/m³ is considered to be perfect in quality, the density of good colostrum varies from 1.050 to 1.059 kg/m³. Colostrum with a density of less than 1.040 kg/m³ is considered unsuitable for the first feeding of a newborn calf [10].

In the experimental groups the colostrum obtained exceeded quality of the one from the control group. This demonstrates improving of colostrum quality due to introduction of the Tirsana BSC energy supplement into the diet of highly productive Ayrshire cows.

4. Conclusion

In a market economy it is important to produce numerous products at optimal costs, especially at a minimum feed consumption. During the first milking period feed costs per 1 kg of milk in control group were 0.70 EFU, while in experimental 1 and 2-0.65 EFU. That was lower by 7%. When using the studied energy supplement, the consumption of concentrates was reduced from 353 to 327-329 g. That was lower on average by 7%.

Efficiency of TirsanaBSC food additive is also economically profitable. At the price of 190 rubles per 1 kg of supplement, for the first milking period we received extra profit for each cow in the experimental groups, which is 2.7 times higher than the cost of the studied energy supplement.

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