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New Nutrient Energy Feed Additive in Red-Motley Calves' Diet during the Lactation Period of Breeding

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Abstract

Currently, the search for alternative ways to replace synthetic feed additives with environmentally safe natural feed additives with specified nutrient compositions in animal husbandry is being intensively pursued all over the world, including Russia.
The article presents the results of the effect of using coniferous-energy feed additive in diets on the indices of nutrient digestibility, hematological, live weight dynamics, and average daily growth rate of calves. The experimental group was formed according to the principle of paired peers. Four groups of 5 animals in each were formed from the selected animals. The control group received the basic diet only, and the experimental group received basic diet plus a pine-energy daily feeding additive (experiments 1, 2, 3) with the dosages of 10, 15, and 20 at the beginning of the experiment and up to 56, 80, and 103 g per head per day at the end of the experiment, respectively. It was found that adding the coniferous-energy supplement from 15 to 80 g per calf per day from the 1st to the 6th month of age ensures the stable intensity of calf growth during the lactation period of breeding. It was concluded that feeding calves with the coniferous-energy feed additive improves metabolism and increases the growth energy and development of young cattle.

Keywords: Calves, Red-motley breed, Feed, Coniferous-energy supplement, Live weight, Average daily gain

Introduction

One of the most important tasks of Russia's agro-industrial complex is to ensure the country's food security and meet market demand for nutritious and high-quality foodstuffs and agricultural raw materials of own production (Karagodin *et al.*, 2020). This is impossible to achieve without organizing the full and balanced feeding of farm animals as a key factor influencing their productivity.

Numerous scientific studies and experience of practicing livestock breeders prove the statement that a complete feeding of farm animals is possible only when using various biologically active feed additives in rations (Prytkov *et al.*, 2017a; Prytkov *et al.*, 2017b; Nagdalian *et al.*, 2020).

Currently, the search for alternative ways to replace synthetic feed additives with environmentally safe natural feed additives with specified nutrient compositions in animal husbandry is being intensively pursued all over the world, including Russia.

In this regard, there is a constant search, development, and testing of new, cheaper, eco-friendly, and safe feed additives based on mobile complexes for the processing of forest biomass.

However, there is little information about the effect of the coniferous-energy supplement on the metabolic parameters of the body and the growth energy of growing animals. Therefore, identifying the optimal dosage of the coniferous-energy supplement in calf diets during the lactation period of growing and studying its effect on indicators of nutrient digestibility of forages; the intensity of growth and biochemical status of blood is relevant and represents a certain interest for science and practical production.

Materials and Methods

To solve the set tasks under the production conditions of the "Agrosoyuz" LLC, Ruzaevsky municipal district of the Republic of Mordovia, a scientific and economic experiment was carried out with a balance experiment in the background. The experiment was conducted on red-motley breed calves from 1 to 6 months of age.

The experimental groups of animals were formed according to the principle of paired peers, considering the breed, gender, age, live weight, individual characteristics, and origin. Four groups of 5 animals in each were formed from the selected animals.

The live weight of the calves for the experiments ranged from 50.0 to 57.0 kg and all animals were clinically healthy and kept in the

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same conditions. Feeding of young cattle was two times per day during all studied age periods of the experiments. Diets and feeding schemes for the experimental animals during scientific, economic, and balance experiments were made according to the recommended detailed norms of the Russian Academy of Agricultural Sciences (2003) with regard to their age, live weight, productivity, and chemical composition of the local forages. The basic ration during the stabling period consisted of: whole milk, brome hay, maize silage, and animal feed. During the scientific economic experiment, experimental animals received, in addition to the basic diet, a pine-energy daily feeding additive (experiments 1, 2, 3) with the dosages of 10, 15, and 20 at the beginning of the experiment and up to 56, 80, and 103 g per head per day at the end of the experiment, respectively. The recommended doses of the coniferous-energy feed additive were fed to experimental animals in a mixture with concentrated feed (Kalashnikov *et al.*, 2003).

Results and Discussion

The formation of the productivity of farm animals largely depends on the increase in their absorption of nutrients of the used feed, which depends on many factors: individual characteristics of the animal, the direction of productivity, gender, age, physiological state, the technology of preparation of feed and its preparation for feeding, type and structure of diets, level and ratio nutritional elements in them, and the presence of biologically active and mineral substances. Insufficient feeding in any respect makes it incomplete and has a significant impact on productivity and feed use efficiency. With a prolonged deficiency of substances necessary for life in the feed, animals develop various non-communicable diseases (Prytkov *et al.*, 2015; Chervyakov *et al.*, 2016; Prytkov & Kistina, 2018).

In this regard, we conducted studies on the effect of different dosages of the coniferous-energy feed additive on the digestibility of nutrients in calves from 3 to 6 months of age.

Our studies have shown that during the study period, the animals of experimental group 2 receiving the coniferous-energy feed additive from 3 to 6 months of age, 39 and 80 g per head per day, respectively showed an increase in digestibility of dry matter, organic matter, and crude protein by 3.3, 2.2, 3.3% than those of the control group, which received a farm diet without the coniferous-energy feed additive **(Table 1)**.

Table 1. Coefficients of nutrient digestibility

Indices	Groups			
	Control	I Experimental	II Experimental	III Experimental
Dry matter	65.27±0.86	68.18±0.68*	71.43±0.25**	69.22±0.32*
Organic matter	68.38±1.29	73.87±0.51*	76.08±0.86**	74.06±0.33**
Crude protein	66.90±2.78	69.76±0.46	73.06±0.38	71.07±0.25
Crude fat	62.98±2.08	63.98±0.60	65.94±1.74	64.73±1.25
Crude fibre	43.76±1.90	43.82±0.31	49.2±1.41	45.27±1.24
Nitrogen-free extract	81.96±1.54	82.45±0.53	86.33±1.41	85.07±2.01

*P<0.05; **P<0.01

When the dosage of the coniferous-energy feed additive was increased to 50-103 g per head per day, there was a tendency for a decrease in the digestibility of nutrients, but these indicators were still higher than those of the control group calves.

According to the results of the scientific economic experiment, it was found that different doses of the coniferous-energy supplement in diets had a definite influence on the dynamics of the live weight of calves.

The greatest absolute increase in live weight of calves from 1 to 6 months of age was observed in animals of the 2nd experimental group fed with the coniferous-energy feed additive from 15 to 80 g per day and was 119.8 kg or 10.62% higher compared to the control group **(Table 2)**.

A similar pattern was found in the average daily gain, the highest rate was found in group 2 and amounted to 783.0 g during the breeding period (from 1 to 6 months of age).

Table 2. Live weight dynamics of calves (kg)

Indices	Group			
	Control	I experimental	II Experimental	III Experimental
At the birth	34.5±1.05	35.1±1.04	34.7±1.27	35.5±0.77
1	52.4±1.21	53.1±0.73	53.7±1.39	54.3±1.41
2	68.6±1.42	73.2±1.09	73.8±1.12	72.2±1.12
3	89.6±0.85	93.8±0.82	94.2±1.32	93.1±0.90
4	114.7±0.92	118.7±1.36	121.2±0.88	120.4±1.39
5	138.9±1.11	144.1±1.37	148.6±1.02	147.2±1.14

6	160.7±0.81	169.6±1.08	173.5±1.03	170.9±0.96
Absolute gain, kg	126.2±8.17	134.5±7.14**	138.8±10.71***	135.4±11.5**
Average daily gain, g	689.6±12.11	735.0±9.13*	758.5±8.15**	739.9±11.40*

*P<0.05; **P<0.01; **P<0.001

To control the physiological state and biochemical processes in the body of experimental animals under the influence of different doses of the coniferous-energy feed additive, we studied the dynamics of hematological parameters of calves during the lactation period of breeding. The analysis of the obtained data showed that the blood of the 2nd experimental group showed an increase in the content of erythrocytes and hemoglobin in 3 months of age by 19.04 and 4.41%, respectively; in 6 months of age — by 7.06 and 2.23% compared to the control group.

Thus, we can conclude that the coniferous-energy feed additive in an amount of 15 to 80 g per head at the age of 1 to 6 months has a more favorable effect on the metabolic processes in the bodies of calves in the 2nd experimental group **(Table 3)**.

Table 3. Hematological indices of calves

Indices	Control	I Experimental	II Experimental	III Experimental
3 month				
Haemoglobin, g/l	124.12±2.1	127.04±2.4	129.60±1.8	126.30±2.8
Red blood cells, CO ^{12}/l	6.30±0.08	6.80±0.10*	7.50±0.11***	7.30±0.08***
White blood cell, 10 ^{9}/l	8.48±2.3	7.40±2.0	7.25±2.1	7.46±1.2
Total protein, g/l	50.20±1.8	52.30±1.6	53.30±2.0	52.20±1.6
AST units/mL	0.27±0.02	0.29±0.03	0.28±0.03	0.29±0.08
ALT units/mL	0.30±0.04	0.34±0.05	0.35±0.02	0.33±0.09
6 month				
Haemoglobin, g/l	125.45±2.3	126.25±0.48	128.25±0.75	123.65±0.24
Red blood cells, CO ^{12}/l	7.22±0.06	7.52±0.04*	7.73±0.03**	7.46±0.05**
White blood cell, 10 ^{9}/l	10.62±1.6	8.35±0.08	8.23±0.12	8.47±0.30
Total protein, g/l	77.2±2.2	79.54±1.34	79.69±1.60	78.6±2.20
AST units/mL	0.26±0.0	0.29±0.03	0.32±0.04	0.28±0.05
ALT units/mL	0.25±0.06	0.31±0.04	0.35±0.04	0.33±0.08

*P<0.05; **P<0.01; **P<0.001

Conclusion

Based on the analysis of the results of the scientific economic experiment, it can be concluded that feeding calves with the coniferous-energy feed additive in the composition of diets during the lactation period in the amount from 15 to 89 g per head per day from 3 to 6 months of age improves metabolism and increases the growth energy and development of young cattle.

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