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Increasing Economic Efficiency of Cow Milk Production in the First Phase of Lactation

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Abstract*: The article considers the economic efficiency of the use of the PassPro Balance feed product for lactating cows based on the increase of their productivity and reproductive qualities. The study has found that the use of the PassPro Balance feed supplement in the ration of Simmental cows during milking period increases the consumption of feed mixture by 0.9% and dry matter – by 5.4%, average daily milk yield – by 29.2% (P<0.01) and profitability level of milk production – by 7.8%, as well as reduces the service period by 5.0% and the consumption of concentrates for the production of 1 kg of basic fat milk by 22.8%.

***Keywords*: newly calved cows, "protected" protein, average daily milk yield, fat, profitability level.**

I. INTRODUCTION

The cattle are an important sector of animal breeding, which plays a significant role in the economy of the industry and is an integral part of the food production system of the population. In the Russian Federation, the amount of milk production increases annually. Animal productivity increases due to the transition of farms of all ownership forms to intensive production technologies of animal breeding. Therefore, it is especially important to develop proper feeding strategies so that the animal breeding system corresponds with available resources [1-7]. There is a general interest in optimizing the use of feed protein for ruminants, taking into account various production characteristics.

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It is necessary that the production of "protected" protein is performed by the feed industry on a commercial scale and is in consumer demand since such feeding positively affects health, longevity and milk production of cows [8, 9, 2, 10].

II. LITERATURE REVIEW

Tough modern technological conditions for feeding and keeping cows in intensive animal breeding are the cause of metabolic disturbances, lack of genetically determined productivity and premature culling of animals. Various physiological periods, in particular, calving stress, milking, as well as periods of changing feeding types and schedules, are interconnected with the changes in the digestive system. Due to the dysfunctions of pancreatic and intestinal digestion with a decrease in feed consumption, there is a lack of nutrients, protein and energy in the metabolism of newly calved cows [9, 11, 12].

The complex stomach of ruminants and its microbiological processes allow microflora to use nitrogen of amino acids, amides and, partially, nitrogen of soluble protein fractions more easily. This has a decisive influence on the availability of protein and amino acids in the body. Modern approaches to the physiology of ruminant nutrition are based on the opinion that the animal's need for protein is satisfied by amino acids of microbial protein and protein undecomposed in the rumen. Therefore, the main factor in providing ruminants with protein and its effective use is the creation of favourable conditions in the rumen, ensuring maximum microbial protein synthesis through the use of a part of "crude protein" feed nitrogen and the simultaneous entry into the intestine of the stored amount of feed protein [11, 2, 13, 14].

With the transition to the acidic conditions of the abomasum, the protected protein denatures and begins to unwind, allowing the digestive enzymes to enter the molecule, breaking down the protein into its constituent abomasum and used to synthesize milk [12, 13, 15, 16].

Currently, the complexes of "transit" proteins are used as a part of the high-protein feed to increase the milk productivity of cows [5].The aim of the research is to study the economic efficiency of using the PassPro Balance feed product (Protect&Feed, Dinskoy District, Krasnodar Territory, Russia) in feeding lactating cows.

To achieve the above-mentioned aim, the following tasks were set and solved:

1. To study the influence of the PassPro Balance feed product on the daily milk yield of Simmental cows during milking period, as well as milk fat and protein content based on the production amount of basic fat milk.

2. To determine the influence of the studied component on the health and reproductive qualities of cows as an important indicator of their productive longevity.
3. To calculate the economic efficiency of using "protected" protein feed supplement in the rations of Simmental cows.

The object of the study is newly calved Simmental cows at the age of two-three lactations.

III. PROPOSED METHODOLOGY

A. General Description

To achieve this aim, a scientific and economic experiment was conducted at the dairy farm of the collective farm "Bolshevik" in the Kalacheevskii district of the Voronezh region. For the experiment, according to the principle of analogue pairs [17], two groups of Simmental cows were selected (14 animals in each group) during the first phase of lactation. The experiment was performed during the milking period of cows (up to 100 days of lactation). Before the 11th day of lactation, a preparatory period was carried out.

To determine the consumption of feed mixtures by animals, control feedings were performed (every ten-day accounting of feed and leftovers). According to the results of the accounting, the actual feed consumption was calculated, as well as the average for the experimental period.

B. Algorithm

To control the productivity, control milking was carried out every ten days. Simultaneously, the contents of milk protein and fat were checked using the Lactan device. The calculation method allowed to determine the amount of the produced basic fat milk (3.4%). Statistical data processing was performed using the program Statistica v. 6. The reliability criterion was determined using Student's t-test.

The reproductive qualities of cows were evaluated based on specified dates of successful insemination to determine the duration of the service period and the number of inseminations.To confirm the economic efficiency of using the studied feed supplement, production costs, feed costs, profit per head, profitability level and concentrate consumption per 1 kg of basic fat milk were determined.

The schedules of feeding, milking and keeping animals corresponded to the system adopted on the farm regardless of animal groups. Animal housing was loose; feeding was carried out using complete mixed ration.

The main ration of the control and experimental groups of cows consisted of the following basic feeds:

- corn silage – 12 kg;
- cereal haylage – 6.2 kg;
- meadow hay – 3.3 kg.

The concentrate part for the first group consisted of grain mixture and was introduced into the ration in the amount of 6.5 kg. Its composition was as follows:

- corn – 40%;
- barley – 35%;
- pea – 5%;
- sunflower cake – 20%.

Two kilos of PassPro Balance were introduced into the feed mixture of the experimental group in addition to the concentrate.The PassPro Balance feed production technology is based on the extrusion of oil crops, expansion and then additional processing of the product under pressure and temperature to the desired parameters of protection from breaking in the rumen of polygastric animals. Processing modes are selected so that digestibility in the small intestine remains at a high level. PassPro Balance contains (in terms of absolutely dry matter): 42.0% of crude protein, 8.5% of crude fat, 6.4% of crude fibre and 12.3 MJ of metabolic energy; "protected" soy and sunflower proteins have a stable protein protection index (content of protein undecomposed in the rumen is 65-70%) with digestibility of up to 95-96%. Due to the high content of undecomposed protein in the rumen, when using PassPro Balance, a negative load on the animal's liver is reduced.

IV. RESULT ANALYSIS

It was found that PassPro Balance made it possible to increase the consumption of feed mixture by 0.9%, dry matter – by 5.4%, metabolic energy – by 7.8% and crude protein – by 9.4%.The analysis of the milk productivity of cows revealed an increase in the average daily milk yield during the first third of lactation in the experimental group by 29.2% ($P<0.01$). The fat and protein contents in the milk of the cows of the experimental group slightly increased.

The calculations of the economic efficiency of milk production in the experiment are presented in Table 1.

Table 1. Economic efficiency of milk production.

Indexes	Group	
	1 – control	2 – experimental
Average daily milk yield at the beginning of the experiment, kg/head	18.25±1.47	18.21±1.50
Average daily milk yield, kg/head	18.50±1.24	23.90±1.18**
Mass fraction of fat, %	3.57±0.04	3.58±0.03
Mass fraction of protein, %	3.01±0.05	3.02±0.04
Basic (3.4%) fat milk, kg	2,311.58	2,994.67
Selling price of 1 kg of milk, rubles	24.0	24.0
Selling price of milk, rubles	55,477.80	71,872.08
Production costs, rubles	45,565.1	53,419.1
Feed cost, rubles	20,559.6	28,413.6
Profit per head, rubles	9,912.70	18,452.98
Additional profit per head, rubles	-	8,540.28
Profitability level, %	17.87	25.67
Consumption of concentrates per 1 kg of basic fat milk, g	334.6	258.3
% under control	100.0	77.2

The study found that the cost of feed consumed due to the use of the studied protein supplement increased by 38.2%, or 66 rubles per cow per day. As a result of the significant increase in productivity, 8,540.28 rubles of additional profit per cow were received. The reduction in the consumption of concentrates for the production of 1 kg of basic fat milk by cows amounted to 22.8%. The profitability level of milk production increased by 7.8%.

It should be noted that during the experiment, despite the productivity increase, there was no increase in the incidence of animals with mastitis in the herd of cows. In addition, in the course of the study, the cows of the experimental group that were in heat had more pronounced features of coming in heat compared with the cows before the experiment. The expressivity of coming in heat of cows increased, which indicates the normalization of hormonal metabolism in animals and their proper feeding. It was revealed that when using the PassPro Balance feed supplement during milking, the service period in the experimental group of cows reduced by 5.0% compared with the control animals. Moreover, the number of cows inseminated within 90 days after calving in the experimental group increased by 20.0%.

V. CONCLUSION

Based on the obtained results, it was found that using the PassPro Balance supplement for cows during the milking period helped to increase the consumption of feed mixture by 0.9%, dry matter – by 5.4%, metabolic energy – by 7.8%, crude protein – by 9.4%, as well as average daily milk yield – by 29.2% ($P<0.01$). The number of cows inseminated within 90 days after calving increased by 20.0%. The cost of the consumed feed increased by 38.2%, or 66 rubles per cow per day due to the use of the studied protein supplement while the profitability level of milk production increased by 7.8%. The duration of the service period decreased by 5.0% and the consumption of concentrates for the production of 1 kg of basic fat milk – by 22.8%.

Thus, high economic efficiency of using the PassPro Balance feed product as an essential component for balanced rations, ensuring the increase in productivity and profitability level of milk production, as well as reproductive qualities of cows, has been experimentally confirmed.

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