The use of wastes from the fat-and-oil industry in feeding calves in order to improve environmental safety

O Yu Bryukhno, S I Nikolaev, S Yu Agapov, E A Lipova, V N Agapova and D N Spiridonov

Volgograd State Agrarian University, 26 University Avenue, Volgograd, 400002, Russia

E-mail: o.bruxno@yandex.ru

Abstract. The present article provides the results of the commercial farm-based scientific trial conducted in calves up to six months of the age. In the rearing period of young animals, a promising technology would be the way, when premixes are included in the diet in the dairy period. The conducted study showed that the use of fat and oil industry waste as the basis for premixes helps to solve several problems, namely, to expand the ingredient list and provide alternative materials for farm animals, which allows to increase the protein level in animal diet, as well as to solve the problem of disposal the waste from the fat-and-oil industry. The experiment carried out on the Holstein dairy cows positively estimated the studied premix ZP61-2S. The results show that giving it to the calves had a beneficial effect on the digestibility of dry matter, which was better in the animals of the experimental group by 2.1% than in the control and amounted to 75.2%. Nitrogen utilization by animals in both control and experimental groups were not reduced, and the balance was positive. Thus, the ZP61-2S premix in the compound feed for young cattle increases the average daily gain of animals by 6.85%.

1. Introduction
Present time, the most important challenge of cattle breeding in the country is to obtain fast-growing animals, which are resistant to diseases and with a well-developed constitution [1, 2, 3].

For the improving of the production processes in animal rearing, it is necessary to combine of the biological characteristics and individual development of animals with modern technological practices [4]. A highly productive adult animal can be obtained only if since the beginning of growth, the ingredient base was well controlled and all nutritional requirements of the animals were strictly covered.

For many years, scientists around the world have been studying the impact of feed and feeding principles on the productivity of farm animals [5]. The results of a number of scientific research works testify, that animal productivity and production indicators are determined by growth with an improvement in the feed base, reasonable use of feed resources and an increase in the quality of diets [6].

The production of livestock products largely depends on the condition and diversity of the forage base. Improvement of the fodder base should go along the ways of organizing an intensive fodder production system and a modern fodder industry. The inclusion of various balancing materials and biologically active substances in the diet allows to provide to the animals of all types with the adequate nutrition, which is currently far behind of the needs of animal husbandry [4, 7].
To ensure high productivity of modern cattle breeds, it is necessary to increase the request for the quality of their nutrition [5]. This can be done by using nutritionally balanced diets in animal feeding with the use of biologically active substances and highly effective feed additives [8, 9].

Plant food is an essential source of minerals and vitamins for all types of animals. The quality of feed and its mineral composition greatly depends on many parameters. When animals lack any macro- and microelements, many farms use mineral supplements to balance the diets [10, 11].

In order to produce livestock products, a large amount of vegetable protein is required. An animal needs to use about 7 kg of vegetable protein to get one kg of animal protein. Thus, it is advantageous to use oilcakes, meal, and industrial waste in animal feeding [12].

The search for fundamentally new ways and economic justification of technological solutions in the production of new types of feed based on food waste is of current importance [13].

In this connection, the purpose of the experiment was to investigate the effect of the ZP61-2S premix on the growth and digestibility of feed nutrients by dairy calves.

2. Materials and methods

Current experiment was conducted in the facilities of the commercial farm in Volgograd region. The studies were carried out on young cattle. The experiment consisted of two stages. First of all, the raw materials for the base of the ZP61-2S premix were studied and the chemical and amino acid analysis of feed were carried out. In the second stage, the effect of the ZP61-2S premix on the growth of calves was determined in the trial.

The Volgograd region occupies one of the leading places in the production of mustard cake. At the end of the 20th century our colleagues of Volgograd State Agricultural Academy invented a technology for the neutralization of antinutritional factors in mustard cake. The final product of this neutralization was named the feed concentrate "Sarepta" [9]. It appears as a well-flowing substance. Its particle size is 0.98 mm in average. Its pH is close to the neutral, about 6.7. It contains 39.0% of crude protein, 8.90% of crude fat, the sum of amino acids in the Sarepta concentrate is 25.54%. According to the results of the study, it was determined as feed material, which has no disadvantages compared to the traditional kinds of materials used as the premix base, and could be used for this purpose.

The largest nutritional company in our region LLC "Megamix" developed formula of the experimental premix ZP61-2S for dairy calves based on feed concentrate from vegetable raw materials "Sarepta".

When developing a new premix, all modern research on the nutritional requirements of animals for energy, protein, fiber, vitamins, macro- and microelements, and other nutrients, and also parameters like gender and targeted productivity, were taken into account.

One kg of the ZP61-2S premix contains: vitamin A (92000 IU), vitamin D3 (71000 IU), vitamin E (77.0 mg), copper (69.0 mg), zinc (1074.0 mg), manganese (767.0 mg), cobalt (15.0 mg), iodine (22.0 mg), selenium (3.0 mg), lysine (36.0 g), methionine (14.6 g), toxin binder "Toxfin" (500.0 mg), probiotic "Bacell" (5000.0 mg), antioxidant "Luktanox" (45.0 mg), Limstone (20.0 g).

Premix for calves of the control group included the same components, but the filler in it was regular sunflower cake.

Studies were conducted on young cattle 30 heads in total. Calves were distributed into two groups using the method of analogue-groups. When distributing animals into groups, age, physiological state, body weight and body condition were taken into account. The conditions of their feeding and keeping were identical.

The ration of both groups consisted of: alfalfa and Sudanese hay, corn silage, motley grass haylage and compound feed (Table 1). In order to provide animals of all groups with macro- and microelements, vitamins, amino acids, a premix was introduced into the feed. In the diet of the control group - the standard premix ZP61-2S, and in the experimental group - the premix based on the concentrate "Sarepta".

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Table 1. Average daily ration for experimental calves.

| Indicator                          | Control group | Experimental group |
|-----------------------------------|---------------|--------------------|
| Alfalfa hay, kg                   | 1.0           | 1.0                |
| Sudanese hay, kg                  | 1.3           | 1.3                |
| Corn silage, kg                   | 4.0           | 4.0                |
| Mixed grass haylage, kg           | 4.0           | 4.0                |
| Compound feed, kg                 | 3.0           | 3.0                |
| The diet contains:                |               |                    |
| Fodder Unit                       | 3.6           | 3.6                |
| Metabolic energy, MJ              | 38.3          | 37.9               |
| Dry matter, g                     | 3.5           | 3.5                |
| Crude protein, g                  | 591.7         | 593.7              |
| Digest. protein, g                | 402.0         | 404.0              |
| Crude fiber, g                    | 691.3         | 647.3              |
| Sugar, g                          | 353.7         | 354.7              |
| Crude fat, g                      | 174.0         | 164.0              |
| Calcium, g                        | 34.5          | 35.0               |
| Phosphorus, g                     | 21.5          | 21.6               |
| Magnesium, g                      | 6.6           | 6.7                |
| Potassium, g                      | 52.7          | 53.0               |
| Sulfur, g                         | 8.2           | 8.2                |
| Iron, mg                          | 893.7         | 912.3              |
| Zinc, mg                          | 214.7         | 215.7              |
| Cobalt, mg                        | 4.8           | 4.8                |
| Manganese, mg                     | 442.0         | 444.3              |
| Iodine, mg                        | 0.8           | 0.8                |
| Carotene, mg                      | 545.0         | 546.0              |
| Vitamin D, IU                     | 0.8           | 0.8                |
| Vitamin E, mg                     | 618.8         | 618.7              |

3. Results and discussion
The experimental premix supported to improve metabolic processes in the body of the calves of the experimental group. This was reflected in the increased digestibility coefficients of all studied feed components (Table 2).

Table 2. Coefficients of digestibility of nutrients in the diet, %.

| Group            | Matter           | Protein       | Fiber         | Fat             | Nitrogen-free extractive substances |
|------------------|------------------|---------------|---------------|------------------|-------------------------------------|
|                  | Dry             | Organic       |               |                  |                                     |
| Control          | 73.1 ± 1.3      | 75.2 ± 1.6    | 72.2 ± 1.1    | 64.0 ± 2.1       | 73.9 ± 2.4                          | 78.1 ± 2.3                          |
| Experimental     | 75.2 ± 1.5      | 76.5 ± 1.3    | 75.1 ± 2.6    | 65.2 ± 2.3       | 74.3 ± 8.4                          | 79.2 ± 0.8                          |

From the second table we see that the digestibility of nutrients in the diet of calves in the experimental group were higher to the analogs from the control group. The digested dry matter in the body in the experimental group was 2.11% higher than in the control group. Digestibility of organic matter in the experimental group was 1.36% higher than in the control group. Inclusion of ZP61-2S premix in the diet given better digestibility of the most important nutrient – crude protein. Digestibility of crude protein in the control group was 72.22%, which is 2.28% lower than in the experimental group. In the experimental group of calves digestibility of crude fat and crude fiber were 0.4% and 1.21% higher than in the control group.
group respectively. Digestibility of nitrogen-free extractive substances was 1.05% higher in the experimental group, compare to the control one.

The results of the trial allow us to see that the inclusion of the ZP61-2S premix in the diet of calves has a positive effect on the digestion processes, especially of the nitrogenous part of the diet (Table 3).

| Parameter                  | Control group | Experimental group |
|----------------------------|---------------|-------------------|
| Consumed with feed         | 94.7 ± 5.8    | 94.9 ± 6.1        |
| Excreted                   | 28.5 ± 2.3    | 28.1 ± 2.4        |
| Digested                   | 66.2 ± 3.7    | 66.7 ± 4.0        |
| Digestibility, %           | 68.9 ± 4.1    | 70.2 ± 4.4        |
| Excreted with the urine    | 32.0 ± 2.9    | 32.0 ± 3.0        |
| Balance                    | 34.2 ± 4.0    | 34.9 ± 4.6        |
| Utilized, %                |               |                   |
| of the consumed            | 36.1 ± 4.4    | 36.7 ± 4.7        |
| of the digested            | 51.6 ± 4.9    | 52.3 ± 4.6        |

The nitrogen balance was positive in all experimental calves. Young animals of the experimental group retained more nitrogen in the body than animals of the control group. Nitrogen in the body of young animals that received a premix based on the “Sarepta” concentrate in the diet was increased due to its decrease in feces. The amount of nitrogen utilized from the consumed was slightly higher in the calves of the experimental group (by 1.47%) (Figure 1).

Due to the fact that the use of nitrogen by a living organism is interconnected with the metabolism of mineral substances, in our experiment balance and utilization of calcium and phosphorus in the body of experimental calves were also studied (Table 4).
The experiment carried out on the Holstein dairy cows positively estimated the studied premix ZP61-2S based on the “Sarepta” concentrate. The results show that giving it to the calves had a beneficial effect on the digestibility of dry matter, which was better in the animals of the experimental group by 2.1% than in the control and amounted to 75.2%. Nitrogen utilization by animals in both control and experimental groups were not reduced, and the balance was positive.

Thus, the ZP61-2S premix in the compound feed for young cattle increases the average daily gain of animals by 6.85%. And this waste of the oil and fat industry can be used as a filler for premixes.
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