Testing of silos from legume-cereal grass mixtures and feed additives in the feeding diets of dairy cows

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Abstract. The production approbation of silos prepared from legume-cereal grass mixtures with the use of an unconventional feed crop – eastern goat and preserved with Biosib biopreparation in experimental versions was carried out. The chemical composition and nutritional value of feed were determined, the structure of feeding rations was calculated, the dose of the energy feed additive was determined. In the balance experiment, the digestibility of the main nutrients of feed was calculated, the hematology of blood was studied. The productivity, costs of concentrated feed and energy for the production of 1 kg of milk are estimated, the main physical, chemical and technological properties of milk from the point of view of butter production are studied, the economic efficiency of using silos in the feeding rations of dairy cows is established.

Keywords: alfalfa, bonfire without a tail, eastern goat, silage, nutritional value, digestibility, technological properties, milk, efficiency.

1. Introduction

The priority in the country's feed balance is to provide animals with a full-fledged protein of their own production. Bulky feeds occupy a special place in the structure of the feed rations of ruminants. The main thing here is to improve the structure of the sown areas and the quality of the feed produced with a high concentration of energy and protein while saving all types of resources and costs. An important technological method for improving the quality of siloed feed is the drying of green mass containing up to 30% of dry matter and the use of bioconservants, which provides the maximum yield of nutrients per unit area [1.5].

The aim of the work was to study the influence of silos prepared from mixtures (alfalfa + bonfire without a tail) and (eastern goat + bonfire without a tail) preserved with Biosib, as well as the energy feed additive Bergafat T-300 on the productivity and technological properties of milk from dairy cows.
2. Methods and materials
In the agrofirm named after. Tsuryupy of the Ufa district of the Republic of Bashkortostan formed three groups of dairy cows of 30 heads each to conduct an experiment on animals based on the principle of pairs-analogues (age at calving, live weight, productivity level for the previous lactation).

The conditions of keeping cows for all groups were the same. The preliminary period of the experiment for adaptation to new feeding diets was two weeks. During the experiment (90 days), the specified feeds and their residues were recorded [2]. In order to determine the digestibility of nutrients according to generally accepted methods, a balance experiment was carried out in the middle of the production test.

The milk productivity and technological properties of the milk of experimental cows were studied by conducting weekly control milking with the determination of the fat and protein content in the milk [11,13]. The conversion of feed nutrients into products was determined according to generally accepted methods. The economic efficiency was calculated based on the feed costs for obtaining 1 kg of milk and its gross milk yield [12]. The following scheme of experience was adopted (Table 1).

| Group of animals | Goals in the group | Feeding characteristics |
|------------------|--------------------|-------------------------|
| 1 control       | 30                 | The main ration (MR) + 20 kg of silage from a mixture of alfalfa and boneless stalk |
| 2 experienced   | 30                 | The main ration (MR) + 20 kg of silage from a mixture of eastern goat and boneless rump |
| 3 experienced   | 30                 | (MR) + 25 kg of silage from a mixture of eastern goat and boneless rump + 300 g of Bergafat T-300 |

3. Results and discussion
Based on the study of the chemical composition, nutritional value and norms of feed requirements, feeding rations for animals of experimental groups were compiled [3,4,10].

The introduction of experimental groups of studied silos into the structure of animal feeding diets contributed to a certain positive change in the usefulness of feeding. Thus, the inclusion of 20 kg of silage from a mixture of non-traditional high-protein feed culture of eastern goat and boneless stalk in the main diet of cows of the 2 experimental group, instead of the same amount of alfalfa and boneless stalk, contributed to an increase in the content of: exchange energy by 3.4 %; crude protein-by 0.6, while reducing the concentration of crude fiber – by 0.4 %. In the III experimental group, where the amount of silage under study was increased to 25 kg using 300 g of an energy feed additive while reducing the proportion of concentrated feed by 25 %, the concentration of EKE increased by 10.6%, crude protein increased by 11.3 %. The feeding rations of experimental cows of all groups were balanced according to the main nutrients and biologically active substances [6-9].

Calculations of the coefficients of digestibility of nutrients of feed of experimental animals showed that the inclusion of 20 kg of silage from a mixture of alfalfa and boneless stalk in the diets of cows of the control group provided digestibility: dry matter at the level of 58.62 %; organic matter-60.14; crude protein-59.74; crude fiber-56.21; crude fat-58.62 and BEV-70.31 %.

The use in the II experimental group of 20 kg of silage from a mixture of eastern goat and boneless rump had a certain effect on the digestibility of feed nutrients with a pronounced tendency to increase them: dry matter – by 2.81 points (P>0.95); organic matter – by 3.72 (P>0.95); crude protein – by 2.38 (P>0.95); crude fat – by 1.57 and BEV – by 1.8 points. Compared with the cows of the I control group, the digestibility of raw fiber in the peers of the experimental groups increased by 3.15 and 3.93 points.

An increase in the amount of silage to 25 kg from a mixture of eastern goat and boneless stalk, as well as the inclusion of an energy feed additive with a decrease in the proportion of concentrates by 25% in the feeding diets of dairy cows of the III experimental group, contributed to an increase in the digestibility of dry matter – by 3.56 points (P>0.99), organic matter – by 4.9 (P>0.99), crude protein –
by 3.41 (P>0.95), crude fat – by 3.52 (P>0.95), crude fiber – by 3.93 (P>0.95) > 0.95) and BEV – by 3.2 points.

The inclusion of 20 and 25 kg of silage from a mixture of eastern goat and boneless stalk, as well as the feed additive Bergafat T-300 in group III in the feeding diets of dairy cows of the experimental groups, contributed to an increase in the total protein content in the blood by 9.2 and 17.1% compared to the control, where the animals received 20 kg of silage from a mixture of alfalfa and boneless stalk. The increase in the level of total protein in the blood of cows of the II and III experimental groups could be a consequence of the activation of the processes of protein biosynthesis in their body. This is confirmed by higher indicators of the nitrogen index in the blood of animals of the II and III experimental groups.

The urea content in the blood of cows of the II and III experimental groups was 0.9 and 1.2 mmol per liter less than that of their peers in the control. The "nitrogen index" in animals of the II and III experimental groups was also higher by 0.9 and 1.4 points than in cows in the control.

Feeding the experimental groups of silage from a mixture of eastern goat and boneless stalk to dairy cows separately and in combination with an energy feed additive contributed to an increase in the content of total lipids in the blood by 2.2 and 6.7 %, carotene by 0.2 and 0.4 mg %, compared with peers from the control group.

The use of experimental groups of studied feeds in winter feeding rations of dairy cows contributed to an increase in the blood content of calcium by 3.8 %, phosphorus – by 5.9 and 11.8% compared to the control, where the animals received 20 kg of silage from a mixture of alfalfa and boneless stalk.

Thus, in the II and III experimental groups, the concentration of hemoglobin increased by 4.9 and 6.9%, respectively, compared with the animals of the control variant. The calculation of red blood cells in the blood of experimental animals showed that in our studies, similar to hemoglobin, their increase was observed in cows of the II and III experimental groups, respectively, by 1.8 and 5.3% compared with analogues from the control.

The use of silage from a mixture of eastern goat and boneless stalk in the feeding of dairy cows in the initial phase of lactation, separately and in combination with the energy feed additive Bergafat T-300, preceded an increase in white blood cells in the blood composition by 2.5 and 6.3% relative to the control peers, which indicated a tendency to achieve higher resistance of their body.

Table 2. Milk productivity of experimental cows

| Indicator                             | Group                  |
|--------------------------------------|------------------------|
|                                      | I control | II experienced | III experienced |
| Natural milk is produced, kg         | 1566      | 1701          | 1728            |
| Daily milk yield, kg                 | 17.4 ± 0.46 | 18.9 ± 0.44   | 19.2 ± 0.48     |
| Fat content of milk, %               | 3.82 ± 0.09 | 3.96 ± 0.06   | 4.00 ± 0.08     |
| In % of the control                  | 100       | 103.7         | 104.7           |
| Daily milk yield of 4 % milk, kg     | 16.6 ± 0.48 | 18.2 ± 0.45   | 19.2 ± 0.47     |
| In % of the control                  | 100       | 109.6         | 115.7           |
| The coefficient of milk content      | 835.7     | 902.8         | 933.3           |

An important indicator of dairy productivity of dairy cows is the coefficient of milk production (the amount of milk produced per 100 kg of live weight), which in the II and III experimental groups were 8.0 and 11.7 % higher than those of analogues in the control (table 2).

In the structure of the cost of milk production, feed costs account for 50-55% of all costs. Studies have shown that the cost of concentrated feed for the production of 1 kg of milk in cows of the II experimental group was 8.7% lower compared to the control. Cows of the experimental group III, who received 25 kg of silage from a mixture of eastern goat and boneless stalk in combination with 300 g/head/day of an energy supplement with a simultaneous decrease in the proportion of concentrated feed by 25 %, spent grain feed by 35.3% less compared to the control. In absolute terms, per 1 kg of milk,
the cows of the experimental groups spent grain feed by 21.0 and 85.0 g less than those of their peers in the control.

The energy costs (EKE) for the production of 1 kg of milk differed slightly between the groups. So, in the control group of dairy cows, 0.94 ECU was spent on the production of 1 kg of milk, and in the experimental ones, 0.86 or 5.5% less was spent.

In the experimental groups, the mass fraction of fat was 0.14-0.18 points higher than in the control cows, which is associated with the activation of fat and carbohydrate metabolism in their body, as well as more intensive processes of scar digestion.

The increased protein content in the milk of cows of the experimental groups by 0.35 and 0.45 points contributed to an increase in the concentration of milk solids by 0.7 and 0.9%

| Table 3. Some physico-chemical and technological properties of milk of experimental cows (on average by groups) |
|--------------------------------------------------|----------------------------------|----------------------------------|
| Indicators                                       | Group I experienced             | Group II experienced            | Group III experienced |
| Dry matter, %                                    | 12.21±0.15                      | 12.29±0.18                      | 12.32±0.13            |
| COMO milk, %                                     | 8.65±0.10                       | 8.66±0.08                       | 8.67±0.06             |
| Fat content of milk, %                           | 3.82±0.06                       | 3.96±0.05                       | 4.00±0.08             |
| Protein content, %                               | 2.91±0.04                       | 3.26±0.03                       | 3.36±0.05             |
| Calcium, mg/l                                    | 127.1±15.16                     | 135.0±18.14                     | 142.0±16.28           |
| Phosphorus, mg/l                                 | 83.1±8.46                       | 95.0±9.18                       | 97.0±7.46             |
| Milk density, A                                   | 28.2±0.05                       | 28.2±0.08                       | 28.1±0.06             |
| Titrated acidity, T                              | 16.61±0.06                      | 16.73±0.09                      | 16.80±0.04            |
| Cream was obtained from 10 kg of milk, kg        | 0,98±0,09                       | 1,03±0,10                       | 1,10±0,08             |
| Duration of whipping cream, min                  | 49±1,83                         | 47±1,96                         | 46±1,79               |
| Fat content in buttermilk, %                     | 0,97±0,03                       | 0,95±0,06                       | 0,80±0,04             |
| Received oil, kg                                 | 0,32±0,01                       | 0,35±0,03                       | 0,38±0,02             |
| Milk consumption per 1 kg of butter, kg          | 31,2±0,76                       | 29,4±0,82                       | 27,8±0,63             |
| Percentage of use of fat from cream              | 97,8±2,11                       | 98,1±2,48                       | 98,6±2,05             |

The concentration of calcium in the milk of cows of the II and III experimental groups was 135.0 and 142.0 mg/l compared to 127.1 mg/l in control peers. A similar picture was observed when studying the phosphorus content in the milk of experimental cows. Thus, the concentration of phosphorus in the milk of cows of the experimental groups was 14.3 and 16.7 % higher than that of analogues in the control.

The density of milk depends on the ratio of its components, which are in a colloidal, dissolved state or in the form of an emulsion. Table 3 shows that the milk density of cows of the experimental group III tends to decrease somewhat, which is a consequence of an increase in the mass fraction of fat in milk.

In our studies, only a certain tendency to increase the titrated acidity of the milk of cows of the experimental groups was found (P <0.95).

When studying the technological properties of milk, from the point of view of processing into butter, the following indicators were taken into account: the duration of churning; the amount of milk spent to obtain 1 kg of butter and the percentage of cream use. In the milk of cows of the II and III experimental groups, the loss of milk fat with buttermilk was reduced by 2.06 and 17.50%. Thus, the percentage of use of milk fat cream in cows of the control group was 97.8 %, and in the experimental groups, respectively, 98.1 and 98.6 %, which is 0.4 and 0.8% more. A decrease in milk consumption for obtaining 1 kg of butter was noted in the experimental groups of animals. If 31.2 kg of milk was spent on the production of 1 kg of butter in the control group cows, then 29.4 and 27.8 kg (P>0.95) were spent in the peers in the II and III experimental groups, respectively. This is due to an increase in the fat content in the milk of cows of the experimental groups.
4. Conclusion
Due to the higher milk productivity of cows in the experimental groups, wage costs, overhead costs, and other direct and indirect costs were higher. The highest costs of milk production in the experimental groups were paid off by the cost of additional products and the cost of a unit of production was naturally lower for them – in the II-th by 150 and in the III-th by 200 rubles. From each dairy cow of the experimental groups, 2799 and 4158 rubles of additional profit were received.

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