Use of feed made from a mixture of cereals and legumes by fresh cows

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Abstract. The ratios of pea and barley seeds for growing in mixed crops for the purpose of preparing juicy feed and obtaining grain fodder in the conditions of low-lying peatlands of the North-East of the Non-Chernozem zone of Russia are determined. Heat treatment of grain fodder from peas and barley in a ratio of 50:50 at a coolant temperature of 110°C a duration of 30 minutes, as well as preservation of silage with LMAC (low molecular acid concentrate) reduced the solubility and cleavability of raw protein in the rumen, contributed to an increase in the use of nitrogen and energy for productive purposes when feeding lactating cows. Feeding of pea and barley silage processed with LMAC in the ratio (25:75) and processed grain mixture (50:50) as part of the main feeding diet of new – bodied cows increased the use of nitrogen taken – by 5.29%, digested-by 8.27 %. During the experiment period, the average daily milk yield of natural milk in the control group averaged 21.18 kg, in II-23.06 and in III – 25.49 kg. The difference in favor of the experimental group III was 4.31 kg (p < 0.05), and in II – 1.88 kg (p < 0.05) or 11.89 and 3.29%, respectively, in terms of 4% milk, the difference was 5.06 and 2.19 kg or 25.08 and 10.86 %. At the same time, the costs of exchange energy for obtaining 1 kg of milk with 4% fat content decreased by 10%, raw protein by more than 7 %.

Keywords: seeds, ratio, pea + barley, heat carrier, LMAC, silage, grain mixture, turf, new-bodied cows, nitrogen and energy balance, productivity, blood.

1. Introduction
Leguminous crops-peas, lupine, feed beans, vetch and soy are predisposed to high solubility, cleavability of raw protein and contain anti-nutritional substances (inhibitors, glucosides, tannins, alkaloids, etc.), which reduce their nutritional value. This leads to a low efficiency of their use in the diets of poly- and monogastric animals. Mixed crops of field crops, as well as modern technologies of their harvesting and preparation of feed for feeding, reduce the influence of these factors. Preserving green mass from a mixture of peas and barley with the use of a chemical preservative helps to increase the safety of protein during storage, and processing such a grain mixture before feeding not only reduces the anti-nutritional properties, but also increases the biological value of the protein, positively affecting the quantity and quality of amino acids available for assimilation by animals [1,5-10].

The main purpose of the work was: development and introduction into production of energy-saving technologies for the production of feed grown in mixed crops of field crops (peas + barley) with different ratios and contributing to the improvement of metabolic processes in the body of dairy cows and increasing milk productivity.
2. Methods and materials
The experiment was carried out at the FSUE "Kirovskaya Lugobolotnaya Experimental Station".

The object was developed, clinically healthy animals. The experiments were carried out under the same conditions of feeding, maintenance and care.

Against the background of scientific and economic experiments, balance tests were carried out in parallel in order to study the digestibility of nutrients, the use of energy and protein, as well as the scar content and biochemical parameters of blood that characterize the state of metabolism in the body.

The preparation of juicy feed from mixed crops was started in the phase of milk-wax ripeness of grain crops [11]. Harvesting of seeds (grain mixtures) was carried out in the mid-waxy ripeness phase, when the grain moisture in cereals was 25-35 %, in legumes 40-50 % (when browning beans on the two lower tiers of plants).

According to GOST 28074-89 and 28075-89, the solubility and cleavability of crude protein were determined in experimental animals (cows) with scar fistula [13].

The scheme of the experience is presented in Table 1.

| Group          | heads | Duration of experiments, days | Conditions, studied feeding rations                           |
|----------------|-------|------------------------------|---------------------------------------------------------------|
| I-control      | 8     | 105 / 90                     | MR (silage without preservative + mixed feed)                 |
| II-experienced | 8     | 105 / 90                     | MR (silage without preservative+processed dirt+premix)       |
| III-experienced| 8     | 105 / 90                     | MR (silo with LMAC + processed dirt + premix)                |

Experiments were carried out on new-bodied cows of a black-and-white breed by the method of analog groups, taking into account the breed, origin, age at calving, live weight, productivity for the previous lactation and the quality characteristics of milk [2,3]. The duration of the scientific and economic experiment is 90 days, preliminary-15. Balance experiments on cows were carried out at the 2nd month of lactation.

The rationing of energy, protein, carbohydrate and mineral nutrition of experimental animals throughout the entire period of experiments was established according to the actual nutritional data of feed established during zootechnical analysis [4].

The dynamics of live weight was determined in cows – before calving, 5 days after calving and monthly, and before the start of the accounting period – two consecutive days before morning feeding.

Milk productivity was taken into account every week and monthly according to the data of control milkings, and during the balance experiments – daily from each cow [12].

3. Results and discussion
Feeding of cows was carried out according to the scheme of experiments. The studied silage was given plenty in the morning, its consumption was: group I-24.6; II – 24.0 and III – 24.6 kg. Before each milking, molasses was distributed in an amount of 0.5 kg per head (only 1.5 kg per day) in a diluted form of 1:4 [13]. In the second half of the day, all cows received silage from perennial grasses dominated by Timofeevka lugovaya for 10 kg. Mixed feed and dirt with premix were fed 3 times a day at the rate of 300 g per liter of milk produced. At night, the animals received 2 kg of hay.

The digestibility of feed nutrients was quite high and differed somewhat between the groups depending on the methods of processing pea-barley dirt and the technology of silage harvesting.

The nitrogen balance in cows indicates its more effective use by cows of group III in comparison with animals of group II and I. The amount of nitrogen deposited in the body and excreted with milk in group III of cows was 295.05 g, in group II-239.87 and in group I – 209.14 g. In group I, 24.47% of the...
given amount was used for milk; in group II – 25.07 and in group III – 27.95%, and from digested, respectively, 34.20; 34.95; 38.78 %.

With an excess of easily soluble protein in the diet, increased nitrogen excretion in the urine was observed due to its inefficient use in the process of microbial synthesis. The analysis showed that more effective use of nitrogen by cows of group III was achieved due to less excretion of it in the urine, compared with animals of group II and I. The amount of nitrogen excreted in the urine by groups was: 1-I-195.19 g; II-169.01 and III – 193.50 g or as a percentage of the specified, respectively, 46.35; 43.40 and 39.62 %. The introduction of “protected” pea and barley meat in the ratio of 50 : 50, as well as silage treated with LMAC in group III, into the feeding ration of cows of group II and III, had a positive effect on the yield of protein available for assimilation and the synthesis of bacterial protein in the pancreas.

The greatest nitrogen release with milk was observed in cows of group III – 136.52 g, while in animals of group II and I-112.64 and 103.05 g, respectively. As the statistical processing showed, the difference between groups I and III, II and III is highly reliable (p < 0.001), and between group I and II is reliable at p < 0.01.

The most nitrogen was deposited in cows of group III and II (22.01 g and 14.59 g), and in the I-th only – 3.04 g. The difference between groups I and III, II and III is significant at p < 0.01. Nitrogen deposition between animals of group I and II was also statistically significant (p < 0.05).

Due to the different amount of gross energy consumption, different use of it was observed in the groups (Table 2).

| Indicator | group | I-control | II-experienced | III-experienced |
|-----------|-------|-----------|----------------|-----------------|
| Taken with food | 298.72 | 310.14 | 232.56 |
| Isolated with feces | 86.25 | 98.03 | 99.33 |
| Overcooked | 202.47 | 212.11 | 224.23 |
| % of energy digestibility | 67.78 | 68.39 | 69.30 |
| Isolated: with urine, | 21.67 | 21.65 | 24.48 |
| with methane | 23.52 | 24.53 | 25.77 |
| Exchange energy | 157.28 | 165.93 | 176.98 |
| Isolated with milk | 64.42 | 70.93 | 79.29 |
| Used EE for growth | 2.20 | 2.55 | 4.27 |
| Milk energy, % of EE | 40.96 | 42.75 | 44.80 |
| KPI of lactation and EE growth, % | 59.62 | 60.36 | 60.87 |

The exchange energy according to the digestibility data was: I-157.58; II-165.93 and III-176.98 MJ. The amount of energy released by milk was: in group I – 64.42; in group II – 70.93 and in group III – 79.29 MJ. In all groups, an increase in live weight was obtained during the experiment: in I-7.92; in II – 9.19 and in III – 15.40 kg. The energy use for an increase per day in the groups was: 2.20; 2.55 and 4.27 MJ, respectively.

The KPI of the OE of the diet for the synthesis of dairy products by groups was: I-59.62; II – 60.36 and III-60.87%. The decrease in the coefficient of productive use of exchange energy in group I was characterized by a less favorable concentration of exchange energy (COE) and an energy – protein ratio (EPO)-10.46 MJ and 0.19 versus 10.59-10.68 MJ and 0.20. And the low level of COE in the dry matter of the feeding diet contributed to the inefficient use of metabolic energy for lactation and growth of the animal, which was confirmed by the results of our study.

During 90 days of lactation, cows of all three groups showed an increase in live weight. However, in the control group, it was 7.92 kg; in II-9.19 and in III – 15.40 kg, or by 40.30 and 48.58 % more than in the control variant. At the same time, the average daily increase in live weight in the groups was, g: I-88; II-102 and III-172. The consumption of raw protein for the formation of 1 kg of milk with 4 % fat
content was not the same and slightly differed between the groups. The largest amount of it was consumed in group I and II – 130.49 and 125.58 g, less in group III-120.67 or 7.53 and 3.91% more than in group III.

An important factor determining the nature of fermentation is the pH value. When the latter was reduced from 7.0 to 5.5, the proportion of acetic and butyric acid decreased. Before feeding the cows, the pH was at the level of 6.9-7.20, after 1 hour of feeding it decreased in group III to 6.04, in group II-6.90 and in group III - to 6.75. The total number of infusoria in group II was slightly higher (345 thousand/mm³) than in groups I and III (144 thousand / mm³) each. The increase in the number of infusoria in the rumen is explained by the predominance of lactic acid fermentation, which in turn shifted the pH of the scar fluid towards an acidic reaction. Biochemical studies of the scar fluid showed that the content of volatile fatty acids (VFA) in the groups was at the level of 4.74-5.97 mmol/100 ml before feeding and 6.12-9.98 mmol/100 ml after 1 hour of feeding. It was found slightly more in cows of group II – 9.98 mmol versus 7.80 mmol/100 ml of group I. An increase in the content of LVK led, in turn, to a decrease in the concentration of hydrogen ions (pH) of the scar fluid by 5-10 %. The total nitrogen content was also maximal before and after feeding in group II-155-201, then in group III – 133-157 and in group I – 130-188 mg %.

The main nitrogenous product for the vital activity of microorganisms is ammonia. Before feeding, its level in the rumen in groups was: I-8.7 mg %, II-12.4 and III – 11.6 mg %. An hour after feeding, it increased: I-22.3 mg %; II-14.8 and III – 21.3 mg %; after 2 hours – 22.7; 17.9; 20.1 mg %, respectively, after 3 hours-27.2; 25.2; 18.1 mg %, after 4 hours-24.5; 21.9 and 15.5 mg %.

In the experiment on cows per 1 ha of crops, the largest amount of milk was obtained when using a silo with LMAC (38.92 % in nutritional value) in a ratio of 25:75, where the yield of 4 % of milk was 431 kg. When fed silage without preservative (36,98 % nutritionally) in the ratio of 25:75 received 397 kg in the control group, which was also used silage without preservative (38,86 % nutritionally) in the same ratio, the yield amounted to 373 kg of milk per 1 ha of crops (table 3).

**Table 3.** milk yield and 4% of fat from 1 ha of crops of peas and barley mixture in the production of silage

| Group | Studied feed | Silage output, cc DM / ha | Average daily DM consumption per day (silage) | Milk yield 4% fat, kg | Milk accounts for the share of silage, kg | Milk yield per 1 kg of silage dry matter, kg | Milk yield 4% fat per hectare, kg |
|-------|--------------|--------------------------|-----------------------------------------------|----------------------|------------------------------------------|------------------------------------------|-------------------------------|
| I     | Silage without preservative 25:75 | 30 | 38.86 | 6.39 | 20.47 | 7.95 | 1,24 | 373 |
| II    | Silage without preservative 25:75 | 30 | 36.98 | 6.24 | 22.36 | 8.27 | 1,32 | 397 |
| III   | Silo with LMAC 25:75 | 31 | 38.92 | 7.06 | 25.23 | 9.82 | 1,39 | 431 |

**4. Conclusion**

All other things being equal, keeping, care and feeding conditions, a decrease in solubility, degradability is more effective on rations containing the highest level of crude protein (DP) in 1 kg of dry matter.
(DM). At 16.01% DP and its solubility of 37.00%, the daily milk yield was 21.18 kg in the control, at 16.63% DP and its solubility 33.40%, productivity increased to 23.06 kg (Group II), and at 16.82% SP and its solubility 30.34% milk yield was 25.49 kg in group III.

The economic efficiency of the feeding rations testified to the expediency of using silage and turf from pea-barley mixtures. As the calculated data showed, a high effect was obtained from experimental cows of groups II and III, where net income was 9550.86 and 18.512.48 rubles.

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