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Natural biologically active additive in feeding calves

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Abstract

Studies on the effectiveness of the inclusion of sodium humate in the diet of young cattle were conducted on four groups of animals. Installed improvement in the consumption of hay by the bulls of the experimental groups by 12.5–20 % compared with the control young was found, as a result of which they consumed more feed units by 1.5, 2.3, and 3.5 %, exchange energy – by 2.4, 3.9 and 5.1 %, digestible protein – by 1.2, 2.1 and 3.7 %. As a result of the inclusion of sodium humate in the diet as part of the KR-2 compound feed, the amount of hemoglobin in the blood of animals of the II experimental group increased by 5.8 %, in III – by 6.8, in IV – by 7.8 % compared to control analogs. With the growth of calves in the blood, the bactericidal activity of blood serum increased by 1.3, 1.9, and 2.5 %, lysozyme activity increased by 0.1 %, 0.2, 0.3 %, which indicates an increase in natural resistance in animals whose diets were injected with the studied peat and sapropel preparation. The use of sodium humate in the feed of bulls in the composition of compound feed KR-2 has a positive effect on the feed consumption, physiological condition, resistance of animals, which provides an increase in the average daily increase in live weight by 3.2–9.4 % while reducing the cost of its production by 2.9–8.5 percent.

Keywords: bulls, feed, sodium humate, resistance, productivity, efficiency.

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1. Introduction

Feeding of farm animals must be carried out according to detailed standards, taking into account the chemical composition and nutritional value of the feed used. This makes it possible to more fully balance the diets, thereby increasing the productivity of animals at the exact feed costs (Slavetsky, 2002; Razumovsky et al., 2002; Yakovchik & Ganushchenko, 2011; Johansson et al., 2012; Amamou et al., 2019; Borshch et al., 2021; Denkovich et al., 2021; Mylostyvyi et al., 2021).

It is possible to provide animal diets with protein, carbohydrates, mineral, and biologically active substances by feeding various feed additives and premixes (Jeroch, 2008; Bogdanovich & Razumovsky, 2019; Petrushko & Bogdanovich, 2019; Prilovskaya et al., 2020; Razumovsky et al., 2020; Vlizlo et al., 2021; Bashchenko et al., 2021).

The creation of a new generation of feed additives with functional properties is of great importance in preparing diets. The inclusion of feed additives with prebiotics in the diet allows you to give the product these properties. Such products support physiological health and reduce the risk of diseases (De Oliveira et al., 2011; Acedo et al., 2011; Bogdanovich, 2019; Bogdanovich & Razumovsky, 2019; Radchikova et al., 2019; Bogdanovich & Razumovsky, 2020).

Such additives in animal feeding make it possible to compensate for the lack of energy, plastic, and regulatory nutrients in the body. It also has a regulating effect on physiological functions and biochemical reactions. This makes it possible to maintain physiological health and reduce the risk

of diseases, including those caused by a violation of the microbial biocenosis of the digestive tract of farm animals (Huuskonen et al., 2009; Shareiko et al., 2013; Valero et al., 2014; Tamkovich et al., 2015).

Inexpensive, highly effective biologically active substances of natural origin are in great demand since they are the most accessible, non-toxic, and do not have an undesirable effect on the animal's body during prolonged feeding (Shareiko et al., 2011; Suchkova et al., 2013; Bogdanovich & Razumovsky, 2019).

One of these additives is sodium humate (humiliate), obtained from peat and sapropel. It has been established that the drug contains several macro-and microelements and amino acids that enter into complex bonds with the help of humic acids. However, its widespread use in feeding farm animals is hindered by insufficient knowledge of the drug's effect on the physiological state and productivity of animals. The norms of its feeding have not been established, which was the reason for our research.

The *purpose* of the research is to study the effectiveness of sodium humate in feeding young cattle.

2. Materials and methods

The studies were carried out on four groups of young cattle of a black-and-white breed with an average live weight of 79-81 kg of 12 heads each (Table 1).

The differences in feeding consisted in the fact that the bulls of the experimental groups were additionally fed sodium humate in doses of 0.4 (II-experimental), 0.5 ml (III-experimental), and 0.6 ml (IV-experimental) per 1 kg of live weight.

Table 1
Scheme of experience

Group	Age of animals, months.	Number of animals, heads	Duration of the period, day	
			Preparatory-6	Main-54
I – control	3	12	MD	The main diet (MD) – WMR, compound feed KR-2, clover-hay timofeevka
II – experienced	3	12	MD	The main diet (MD) +compound feed in a dose of sodium humate 0.4 ml/kg of live weight
III – experienced	3	12	MD	The main diet (MD) + compound feed in a dose of sodium humate 0.5 ml/kg of live weight
IV – experienced	3	12	MD	The main diet (MD) + compound feed in a dose of sodium humate in a dose of 0.6 ml/kg of live weight

All the manipulations with the animals were conducted according to the European Convention for the Protection of Vertebrate Animals used for Experimental and other Scientific Purposes (Official Journal of the European Union L276/33, 2010).

3. Results and discussion

The use of KR-2 compound feed in bulls feeding with the inclusion of a feed additive sodium humate had a positive effect on the feed consumption (Table 2).

Studies have found an increase in hay consumption by the bulls of the experimental groups by 12.5–20 % compared to the control ones. As a result, the animals of the experimental groups consumed more feed units by 1.5, 2.3, and 3.5 %, exchange energy – by 2.4, 3.9, and 5.1 %, digestible protein – by 1.2, 2.1, and 3.7 %. The fiber content was 17.8–17.9 % of the dry matter of the diet. The sugar-protein ratio was at the level of – 0.84–0.55:1. The ratio of calcium to phosphorus in all groups was 1.53–1.65:1.

Hematological indicators also indicate an increase in metabolic processes in the body of animals of the experimental groups (Table 3).

As a result of the conducted studies, it was found that after feeding the sodium humate preparation as part of the KR-2 compound feed, the amount of hemoglobin in the II experimental group increased by 5.8 %, in the III – by 6.8, in the IV – by 7.8 % compared with control peers.

Table 2
Rations of experienced animals

Feed and nutrients	Group			
	I	II	III	IV
Compound feed KR-2, kg	1.5	1.5	1.5	1.5
Clover-timothy hay, kg	0.8	0.9	0.95	0.97
WMR, g	6.0	6.0	6.0	6.0
Milk, l	2.0	2.2	2.3	2.5
The diet contains:				
Feed units	3.45	3.50	3.53	3.57
Metabolizable energy, MJ	33.2	34.0	34.3	34,9
Dry matter, kg	3.06	3.15	3.21	3,30
Crude protein, g	467	477	485	490
Digestible protein, g	328	332	335	340
Crude fat, g	164	165	167	170
Crude fiber, g	545	561	575	589
Sugar, g	177	180	183	187
Calcium, g	19.8	20.5	21.0	22.1
Phosphorus, g	12.9	13.1	13.4	13.4

A tendency has been established to increase the total protein in the blood of calves of experimental groups (II, III, and IV) with the introduction of feed additives by 5.6, 8.1, and 10.7 % compared with control analogs.

The use of sodium feed humate additive in feeding young cattle had a positive effect on phosphorus metabolism. The concentration of this trace element increased in the II experimental group by 3.4 %, in the III – by 4.5 %, and in the IV – by 5.5 % compared to the control group (Table 4).

The calcium content in the blood of experimental calves in comparison with the control indicators increased by 6.8 % (II), 7.2 % (III), and 7.7 % (IV) groups.

The results of studies on the effect of the sodium humate preparation in the compound feed on the natural resistance of calves are shown in Table 5.

With the growth of calves' blood, the bacterial activity of blood serum increased by 1.3, 1.9, and 2.5 %, lysozyme activity – by 0.1 %, 0.2 %, 0.3 %. Consequently, the natural resistance of animals, whose diet also included sodium humate from peat and sapropel, significantly increased during the experiment.

Studies have shown that the average daily gains of calves in the control group amounted to 898 g (Table 6).

Table 3

Morpho-biochemical composition of blood

Indicator	Group			
	I	II	III	IV
Red blood cells, 10^{12}/l	6.3 ± 0.21	6.9 ± 0.29	7.0 ± 0.29	7.1 ± 0.29
Hemoglobin, g/l	102 ± 0.27	108 ± 0.25	109 ± 0.25	110 ± 0.25
White blood cells, 10^{9}/l	7.59 ± 0.03	7.52 ± 0.03	7.56 ± 0.04	7.58 ± 0.04
Total protein, g/l	71.05 ± 0.29	75.2 ± 0.29	77.3 ± 0.29	79.5 ± 0.29
Glucose, mmol/l	4.0 ± 0.15	4.2 ± 0.08	4.3 ± 0.11	4.4 ± 0.22
Acid capacity, mg%	440 ± 2.47	460 ± 2.04	470 ± 2.08	480 ± 2.16
Urea, mmol/l	4.08 ± 0.87	3.81 ± 0.89	4.11 ± 0.14	4.11 ± 0.15

Table 4

Blood mineral composition

Indicator	Group			
	I	II	III	IV
Calcium, mmol/l	3.74 ± 0.06	4.01 ± 0.14	4.03 ± 0.03	4.05 ± 0.08
Phosphorus, mmol/l	2.60 ± 0.04	2.69 ± 0.06	2.72 ± 0.10	2.75 ± 0.05
Magnesium, mmol/l	1.23 ± 0.02	1.23 ± 0.02	1.23 ± 0.02	1.25 ± 0.02
Potassium, mmol/l	9.9 ± 0.04	10.0 ± 0.5	10.3 ± 0.4	10.3 ± 0.4
Sodium, mmol/l	110.3 ± 2.7	110.5 ± 3.3	111.0 ± 3.1	111.1 ± 3.2
Iron, mmol/l	18.7 ± 0.89	18.9 ± 0.87	19.1 ± 0.88	20.3 ± 0.86
Zinc, mmol/l	4.6 ± 3.4	4.6 ± 3.8	4.65 ± 4.5	4.7 ± 1.7
Manganese, mmol/l	1.7 ± 0.1	1.73 ± 0.1	1.75 ± 0.1	1.77 ± 0.1
Copper, mmol/l	12.1 ± 0.78	12.3 ± 0.93	12.4 ± 0.79	12.9 ± 0.48

Table 5

Natural resistance of experimental animals

Indicator	Group			
	I	II	III	IV
Bactericidal activity of blood serum, %	62.3 ± 1.2	63.6 ± 1.0	64.2 ± 1.3	64.8 ± 1.4
Lysozyme activity, %	6.4 ± 0.29	6.5 ± 0.35	6.6 ± 0.33	6.7 ± 0.31
beta-lysozyme activity of blood serum	19.2 ± 0.28	19.3 ± 0.31	19.4 ± 0.31	19.5 ± 0.33

Table 6

Live weight and average daily gain of experience animals

Indicator	Group			
	I	II	III	IV
Bodyweight. g				
at the beginning of the experience	79.0 ± 1.81	79.5 ± 2.15	80.0 ± 8.6	81.0 ± 1.91
at the end of the experience	132.9 ± 4.04	135.1 ± 3.93	137.4 ± 3.68	139.9 ± 3.71
Gross increase, kg	53.9 ± 4.5	55.6 ± 40.10	57.4 ± 3.90	58.9 ± 3.95
Average daily weight gain, g	898 ± 10.2	927 ± 12.3	957 ± 10.8	982 ± 12.9
% to control	100	103.2	106.6	109.4
Feed costs per 1 kg of grain, k units.	3.84	3.78	3.69	3.57
% to control	100.0	98.4	96.1	93.0

The use of sodium humate in feeding young cattle at the rate of 0.4 ml, 0.5, and 0.6 ml per 1 kg of live weight provided an average daily increase in live weight at the level of 927; 957 and 982 g (groups II, III, IV) or 3.2 6.6 and 9.4 % higher than in the control group.

Feeding of 0.4 ml of sodium humate per 1 kg of live weight per day to young cattle as part of compound feed led to a decrease in the cost of growth by 2.9 %, with the inclusion of 0.5 ml per 1 kg of live weight – by 6 % at a dose of 0.6 ml per 1 kg of live weight – by 8.5 % relative to control animals.

4. Conclusions

The inclusion of sodium humate in the diet of young cattle in the composition of compound feed KR-2 has a positive effect on feed consumption, physiological condition, the resistance of animals, which provides an increase in the average daily increase in live weight by 3.2–9.4 %, reducing the cost of its production by 2.9–8.5 percent.

Conflict of interest

The authors declare that there is no conflict of interest.

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