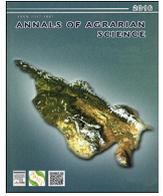




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Application of new mycotoxin adsorbent-bentonite clay “Askangel” in poultry feed



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ABSTRACT

In order to mitigate the negative effect of mycotoxins the major researches have been conducted to obtain the mycotoxins adsorbent in recent years. As for the adsorbents, they are substances of a firm or liquid form, on which surface the mycotoxins are absorbed and prevent transition of mycotoxins from the intestines walls in to blood system. The bentonite clay obtained in western region of Georgia (Guria, Ozurgeti) is characterized with a broad range of ion exchange, high colloidal, enriched, for its wide adsorption characteristics and exchange capacity. It is widely used in oil exploration, filtration of wine, vinegar, oil, production of pharmaceuticals, perfumery, cellulose, it is used in agriculture.

Based on the mentioned characteristic of locally produced bentonite clay, for the purpose of mycotoxins adsorption in ready combined food the various portions (1.0%, 1.5%, 2.0%) of Askangel has been tested on Broiler “Cross-308”. Based on preliminary (10-10 bird in each group) and primary (50-50 birds in each group) experiment the impact of the “Askangel” on broiler productivity and its adsorption capacity has been identified.

The dynamic of the live mass showed that at the start point of the experiment (20 day) in first, second and third (3,4,5) groups the live mass (Tables 2 and 4) was nearly equal 0.8–0.83 kg, at the end of the experiment the advantage of the third, fourth and fifth groups was (the combined food was balanced with Askangel 1%, 1.5%, 2.0%) compared with the first and second groups. The indicator of the third group was ahead by 5.1%, the fourth group by 7.1% and the fifth by 8.2%, accordingly to second control group by 2.7%, 4.7% and 5.8%. In each group we observed poultry feeding, feed utilization and conversion. According to the obtained data the feed conversion in the third testing group compared to the first control group was less by 3%, in the fourth group by 5%, in fifth testing group by 3.7%. Compared to the second group the indicator is as follows: 1.2%, 3.1% and 1.85%. During the experiment, for the physiological tests the samples of manure was taken from all five groups and the mycotoxins adsorption ability of bentonite clay “Askangel” was identified at the LTD “Chirina” laboratory “SANA” using ELIZA method. The highest capacity of adsorption was seen in fifth group, in the mentioned group the Askangel was added with the portion 1.5–2% where the adsorption rate of aflatoxin was 79%, T_2HT_2 adsorption 8.3%.

During the testing period the broiler daily weight gain in third group was 72.8 gr, in fourth 77.5 gr. The less daily weight gain was observed in first and second control groups: 68.2 gr and 69.6 gr.

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1. Introduction

Mycotoxins are secondary metabolic substances of fungi of a microbe mold which are characterized by strong toxic features [1].

Even in insignificant quantity they show high toxicity and they easily diffuse both in food staples and products, and in deep layers of forage of poultry and animals [2]. Today from 400 different types of microscopic fungi are allocated about 300 of mycotoxins, from which 20 types are considered as especially dangerous mycotoxins [3]. Often mycotoxins are found in very low concentration in food plants, which is impossible to remove by chemical or biological methods, they tend to accumulate (stored) [4] in animal or

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Table 1
The scheme of experiment.

No	Group	Quantity	Main combined food %	Quantity of "Askangel"	Note
1.	Control	50	100	–	–
2.	Control	50	99,0	–	1% allyuminsilicate
3.	Test	50	99,0	1,0	–
4.	Test	50	98,5	1,5	–
5.	Test	50	98,0	2,0	–

I - control (No any adsorbents, neither Askangel and nor aluminosilicate was added to the major combined feed (100%).

II-control (to the major combined feed 99% was added imported adsorbent aluminosilicate in 1%).

III- testing (to the major combined feed 99% was added local adsorbent of bentonite Askangel in 1%).

IV- testing (to the major combined feed 98,5% was added local adsorbent of bentonite Askangel in 1.5%).

V- testing (to the major combined feed 98% was added local adsorbent of bentonite Askangel in 2%).

poultry body; mycotoxins causes reduction of the general immunity of an organism, damages kidneys, also a liver, nervous system, blood and gastrointestinal systems [5]. In case of one or more accumulated food mycotoxins further increases the negative impact in the body of animals and poultry [6]. If one considers the fact that farmers purchase the raw materials to make the full-fledged feed [7] from various countries and regions should not be surprising that the food ingredients may be polluted [8] and contained different types of mycotoxins and after they occur in the feed of animals and poultry their body will become a key to the synergistic [9] effect.

At present, from the most dangerous mycotoxins are: Ochratoxines, Aflatoxines, Zearalenone, Trikotsets, Patelin [10]. The most part of the researches conducted in recent years were directed on search and effective use of adsorbents [11]. As for the adsorbents, they are substances of a firm or liquid form [12], on which surface the mycotoxins are absorbed and prevent transition of mycotoxins from the intestines walls in to blood system [13]. Adsorbents can be received as by the artificial-synthetic or microbe way, also by natural way [14]. They are characterized by high micro pore on the basis of which the adsorbent surface area increases, that promotes easy adsorption of toxins [15]. To 1 ton feed is added 0.3–1.0 kg adsorbent. In case of high rate contamination [16] 1.5–2.0 kg per ton. From existing adsorbents are widely used bentonite clays of Aluminosilicate origin [17].

Bentonite is a clay which belongs to the 70% high-disperse porous silicate. It has a crystal structure. Its surface is covered with ionic cations which define its physical and chemical features, and also quality and adsorption speed [18]. The majority of bentonites are characterized by a wide range of action. They detain and

produced bentonite clay Askangel. It is worth to mention that number of people will be employed on its production, besides it will minimize the outflow of currency from the country, which is spent on the import of adsorbent.

2. Material and methods

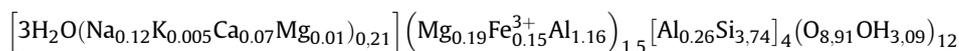
During the experiment period the following was studied:

- Broiler live mass dynamic, defined by the preliminary and primary weighting in the age of 20 and 35 days.
- Absolute mass gain from the broiler, daily weight gain and food conversion during the 20–35 days of breeding.
- Aflatoxin and T₂HT₂- Mycotoxin adsorption in 20–35 days of breeding.

3. Results

The x-ray phase, silicate and physical-chemical researches where undertaken on bentonite clay Askangel at the laboratories of Agricultural University of Georgia, Tbilisi State University, Institute of Minerals Materials of Caucasus after Aleksandre Tvalchrelidze. Based on test results the montmorillonite structure and formula was established. X-ray phase test was conducted on DPOH-1,5 type of device. It was found that montmorillonite was semi-crystallized, quartz and mica was in form of tracks. It belongs to the type of calcium-sodium mixed montmorillonite.

The calculation of montmorillonite (Askangel) according to Borneman-Stankevich Formula is as follows:



eliminate the growth and development of a fungoid mold. The main specific feature of bentonite clay is adsorption and the exchange of cations [19].

In Different regions of Georgia there are some minefield of bentonite clay, among them stand out two - Gumbiri (Imereti, Tskaltubo) and Askana (Guria, Ozurgeti) [20]. Its reserves are expected to be 10 million tons. Despite the fact that high adsorption ability on various directions of Askangel was known before, there was not still explored the possibility of its use in poultry, as most mycotoxins adsorbent, which is very topical and perspective for our country.

Official data [10–19] and the results of testing revealed that for some mycotoxins the best adsorbent can be considered the locally

The structural formula above stipulates that the bentonite clay of Askana belongs to bentonite clay group with high adsorption capacity and exchange rates and is high-quality adsorbent. These features of bentonite clay Askangel, high quality mycotoxin adsorbent, were the precondition to study the possibility of its use in poultry feeding.

During the preliminary testing in each group (10-10 birds) we observed the dynamic of broiler growth, development, resistance and based on this results was conducted the primer experiment. Besides the mentioned indicators, the purpose of the preliminary tests was to identify the effective dosage of Askangel in combined feed of broiler. For the experiment we have selected 20 days broiler. In total we established 5 groups for the testing (Table 1).

First weighting was conducted in age of 20 days, second weighting in age of 14 days.

Table 2

The dynamic of broiler live mas (preliminary test) n = 10.

No	Group	Live mass, Kg		The test duration, (days)
		Start	End	
1	Control	0,835	1750	14
2	Control	0,845	1830	14
3	Test	0,840	1890	14
4	Test	0,810	1900	14
5	Test	0,830	1930	14

The live mass of fifth testing group exceeds by 1.6% the fourth testing group, by 2.1% the third, 5.5% to the second group and by 10.3% the first group.

The live mass of the fourth testing group exceeds by 0.5% the third group, by 3.8% the second group and by 8.6% the first group (Table 2).

After the preliminary test was carried out, we conducted a primer experiment again on the broiler Cross "ROS-308". The 20 days birds were tested and the observation continued till the age of 35 days (slaughtering age), so duration of the experiment was 14 days. as well as for the preliminary testing we selected 20 days old 250 birds, divided them in to 5 groups (50 birds in each group), the experiment scheme was conducted similar to the preliminary test scheme (Table 1).

In order to follow the growth and development of poultry we have weighted birds in the beginning at the age of 20 days and at the end of the test at the age of 35 days (Table 4).

During the course of experiments carried out we studied the absolute increment of broiler, daily growth, percentage of preservation, feed conversion from 20 days to 35 days (Tables 3 and 5).

4. Discussions

At the beginning of the preliminary experiment broiler live weight was almost equal and varied from 0.810 kg to 0.845 kg. At the end of the experiment the highest live mass was seen in III, IV and V group, however in V group the broiler mass exceeded the mass of I group by 10.3%, II group by 5.5%, III – 2.1% and IV by 1.6%. preliminary test trial continued in to the primery experiment

Table 3

Broiler absolute increment, Daily growth, Feed conversion (Preliminary test).

No	Group	The test duration day	Absolute increment gr	Daily growth gr	Preservation %	Feed conversion
1	Control	14	915	65,36	90,0	1,69
2	Control	14	985	70,35	100	1,66
3	Test	14	1050	75,0	90,0	1,65
4	Test	14	1090	77,86	100	1,62
5	Test	14	1100	78,57	100	1,59

Table 4

The dynamic of broiler live mass n = 50.

No	Group	Live mass, Kg		The test duration, (days)
		Beginning	End	
1	Control	0,805 ± 0,030	1760 ± 0,018	14
2	Control	0,825 ± 0,026	1800 ± 0,030	14
3	Test	0,830 ± 0,036	1850 ± 0,024	14
4	Test	0,800 ± 0,033	1885 ± 0,020	14
5	Test	0,830 ± 0,029	1905 ± 0,025	14

Table 5

Broiler absolute increment, daily growth, preservation, feed conversion n = 50.

No	Group	Research duration, day	Absolute increment gr	Daily growth gr	Preservation %	Feed conversion
1	Control	14	955	68,2	100	1,68
2	Control	14	975	69,6	100	1,65
3	Test	14	1020	72,8	100	1,63
4	Test	14	1085	77,5	100	1,60
5	Test	14	1075	76,8	100	1,62

Table 6

Feed conversion in broilers (20–35 day).

Indicators	Size unit	Groups				
		I control	II control	III test	IV test	V test
Quantity of applied feed	kg (gr)	0,510	0520	0,505	0525	0,535
Utilized feed	kg (gr)	0,490	0500	0,495	0510	0,525
Utilized	%	96,08	96,15	98,0	97,14	98,14
Remaining food points	kg (gr)	0,020	0020	0,010	0,015	0010
Quantity of remaining food	%	3,92	3,85	2,00	2,86	1,86

which was conducted to determine the optimal porcion of Askangel in full combined feed for the detoxication of mycotoxins. The live mass dynamic showed (Table 6) that in the beginning of the experiment (20 days) in all five groups the live mass was nearly equal and varied from 0.820 kg to 0.830 kg. The advantage at the age of 35 days in IV and V testing groups was 1885 and 1905 kg. The IV group broilers exceeded the I control group by 125 gr, the II control group by 85 gr, the III control group by 35 gr, but stood behind the V testing group by 20 gr. The group V broiler indications exceeded I control group by 145 gr, II group by 105 gr, III by 55 gr and IV group by 20 gr. The observation on the broiler absolute increment and daily growth (Table 5) demonstrated that from 20 to 35 days this indicator in III group amounted 1.020 kg and 72.8 gr, in IV testing group 1.085 and 77.5 gr, in V group 1.075 and 76.8 gr. The lowest absolute increment and daily growth demonstrated the I control group with 0,955 kg and 68,2 gr and the II control group relevantly with 0,975 kg and 69,6 gr. In order to study the feed utilization and conversion (Table 6) at the age of 32-33-34 day each bird was fed with 170 gr wholesome combined feed. On group with 50 birds was spent daily 8.5 kg feed. table shows that at the age of 32-33-34 day the feed utilization was highest in test groups 97–98%. As for the feed conversion at the age of 20–35 days the better results were seen in group IV and V. During the experiment the physiological tests was conducted. From the groups involved in the experiment samples of manure were taken and the mycotoxins adsorption ability of betonies clay "Askangel" was identified at the LTD "Chirina" laboratory "SANA" on ELIZA method.

The highest capacity of adsorption was seen in fifth group, in the mentioned group the Askangel was added with the portion 1.5–2%, aflatoxin adsorption - 79%, T₂HT₂ adsorption 8.3%.

5. Conclusion

Based on the obtained results of preliminary and primery experiments on poultry (broiler) we can conclude that the application of Askangel, locally produced bentonite clay of aluminicilicat origin, for the detoxication of micotoxins in broiler combined feed is highly effective. By adding Askangel with portion 1.5% in combined feed the mycotoxin adsorbtion reached to 79%, as for T₂HT₂ - 8.3%. As a result of the fact that application of local bentonite clay

Askangel couses: improvement of broiler physiological condition, increases the quality of the food absorption in the gastrointestinal tract, reduces toxicity, reduces feed cost. Also the damage from the contaminated poultry feed will be reduced to a minimum, the meat production will be increased and most important is that the poultry meat will become relatively safe for consumers. According to the results of conducted experiments we finely conclude that our estimation on application of Askangel, locally produced bentonite clay of aluminicilicat origin, for the detoxication of some micotoxins in broiler combined feed has been confirmed by industrial experiment. Based on the results of preliminary and primery experiments on poultry (broiler) by involving in feed bentonite clay Askangel is concluded that:

1. In broiler combined feed locally produced bentonite clay of aluminicilicat origin for the detoxication of micotoxins Askangel, can be used with the porcion 1.5–2%;
2. Damage from the contaminated poultry feed will be reduced;
3. Broiler mass positive dynamic will be increased, absolute and daily growth;
4. Broiler feed utilization and conversion will be increased;
5. For the production of bentonite clay Askangel dozens of people will be employed;
6. it will minimize the outflow of currency from the country, which is spent on the import of adsorbent.

The research results demonstrate that the application of Askangel, locally produced bentonite clay of aluminicilicat origin, for the detoxication of micotoxins in poultry (broiler) feed is highly effective in scientific and practical terms.

Accordingly for the purpose of detoxication of micotoxins in combined feed, Askangel can be used successfully.

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