

RESULTS OF USING TRIPOLI ON ZOOHYGIENIC INDICATORS IN THE RAISING A PARENT HERD OF MEAT BREED CHICKENS

Ivan Kochish^{1*}, Elena Kapitonova², Ilya Nikonov¹, Sergey Shlykov³, Ruslan Omarov³

¹ Department of Zoohygiene and Poultry named after A.K.Danilova, Moscow state Academy of Veterinary Medicine and Biotechnology - MVA by K.I. Skryabin, RUSSIA.

² Department of Private Livestock, Vitebsk State Awarded the «Badge of Honour» Order Veterinary Medicine Academy, BELARUS.

³ Department of Technology of Production and Processing of Agricultural Products, Stavropol State Agrarian University, RUSSIA.

ARTICLE INFO

Article history:

Received 16 June 2020
Received in revised form 31 August 2020
Accepted 14 September 2020
Available online 23 September 2020

Keywords:

Breeding chicken;
Aflatoxin; Adsorption;
Deep litter; Decrease
bacteria and viruses; Egg
acidity; Tripoli rock;
Farm bedding material.

ABSTRACT

This paper presented the results of tripoli influence on the zootechnical parameters of the chickens' parent flock. There was established that the mineral additive Khotimskiy based on tripoli in an acidic medium had pronounced adsorption towards aflatoxin, T-2 toxin, ochratoxin sorbing these toxins by 87-100%. Concerning zearalenone, deoxynivalenol, and fumonisin, an adequate sorption capacity was established at the level of 61-70%. When the medium's pH changes from an acidic reaction to a neutral one, its sorption activity decreases. The addition of a mineral additive to the litter in an amount of 100 g/m² helps eliminate unpleasant odors and leads to a decrease in the number of bacteria and viruses, suppresses fungi and mold, and repels flies. Its use contributes to an increase in the litter material's dryness by 12.5%, a decrease in the acid number of the obtained products (eggs) by 2.3%, and does not harm the gross productivity of laying hens.

Disciplinary: Agricultural and Animal Sciences, Bioscience.

©2020 INT TRANS J ENG MANAG SCI TECH.

1 INTRODUCTION

In the technological process of poultry products' production, it is necessary to know and comply with the requirements of sanitary and mycological control of feed and bedding material. Feed containing mycotoxins is neutralized by one of the methods described by Kapitonova et al., 2012. Simultaneously, for a prolonged effect, the bedding material must be treated with preparations with sorption properties.

Using zeolites shows positive results in various farms in the USA, Japan, Germany, and other

countries. It was found that the inclusion of zeolites in the diet of animals increases the assimilation of nutrients in compound feed and prevents the appearance of dyspepsia (Abraskova, 2012). Promotes eliminating toxic metabolic products prevents diseases associated with micronutrient deficiencies, reducing mortality, especially at an early age (Beregovaya, 2017.).

Having studied the zeolites of all known deposits on the Republic of Belarus' territory, it was recognized that the trefoil of the Khartum district of the Mogilev region has the highest efficiency and the best properties.

Tripoli is an environmentally friendly, loose, finely porous opal rock. Tripoli is a natural mineral of volcanic sedimentary origin, penetrated by the thinnest cavities and channels filled with cations of alkali and alkaline earth metals and water molecules, which give it the properties of a molecular sieve. Tripoli has a high ion-exchange capacity, properties of an adsorbent and a donor, the ability to absorb and give up moisture, prolong the effect of nutrients with which it is mixed, and give the soil and living organisms the elements they need. Tripoli does not cause side effects, gene mutations, and is well tolerated when consumed with food. It enriches the bird's body with macro and microelements and eliminates the problem of intestinal decay and fermentation. In our scientific research, we described the mineral additive "Khotimskiy" tests based on tripoli on the body of a parent flock of meat production of the cross "Ross-308". Zeolite-containing tripoli is capable of absorbing and removing radioisotopes from the body of animals and birds. They are not toxic and do not accumulate in the body. It is used for feed detoxification (with increased mycotoxins, nitrates, nitrites, heavy metals) and into the deep litter. It is a sanitary agent for the sorption and drying of bedding material. The mineral additive Khotimskiy includes tripoli from steel mining, clinoptilolite, and montmorillonite.

2 MATERIALS AND METHODS

Research work included:

- 1 - Study of the adsorption capacity of the mineral additive "Khotimskiy," depending on the pH of the medium (GOST, 2017).
- 2 - Study of the effectiveness of the mineral additive "Khotimskiy" as a sanitary means for drying bedding material when growing poultry;
- 3 - Determination of the thickness of the eggshell (by Orka Egg Shell Thickness Gauge) and the acid number of the product (egg) of the parent flock of the Ross-308 cross, 256 days old (OST, 2003).

Production tests were carried out at OJSC "Vitebsk Broiler Poultry Factory" in the Vitebsk Region, Republic of Belarus. The use of a mineral additive in the bedding material is because when using the unbalanced feed, birds begin to dig the bedding material and snatch out the components that the body needs. If there is a shortage of macro- or microelements, chickens eat or gnaw (peck) the litter material and the enclosing structures.

The experiment was according to the scheme (see Figure 1). As the main ration for the experimental poultry, we used complete feed, in terms of nutritional value, met STB requirements (Podobed, 2016). There was providing round-the-clock and uninterrupted access to drinking water.

The clinical and physiological state of the bird was determined by daily examination, paying attention to the behavior, appetite, consumption of water and feed, mobility, plumage, pigmentation of the legs, development of the ridge, etc. Monitoring of the bird's safety and health was by daily registration of the abandoned bird and analyzing the causes of death.

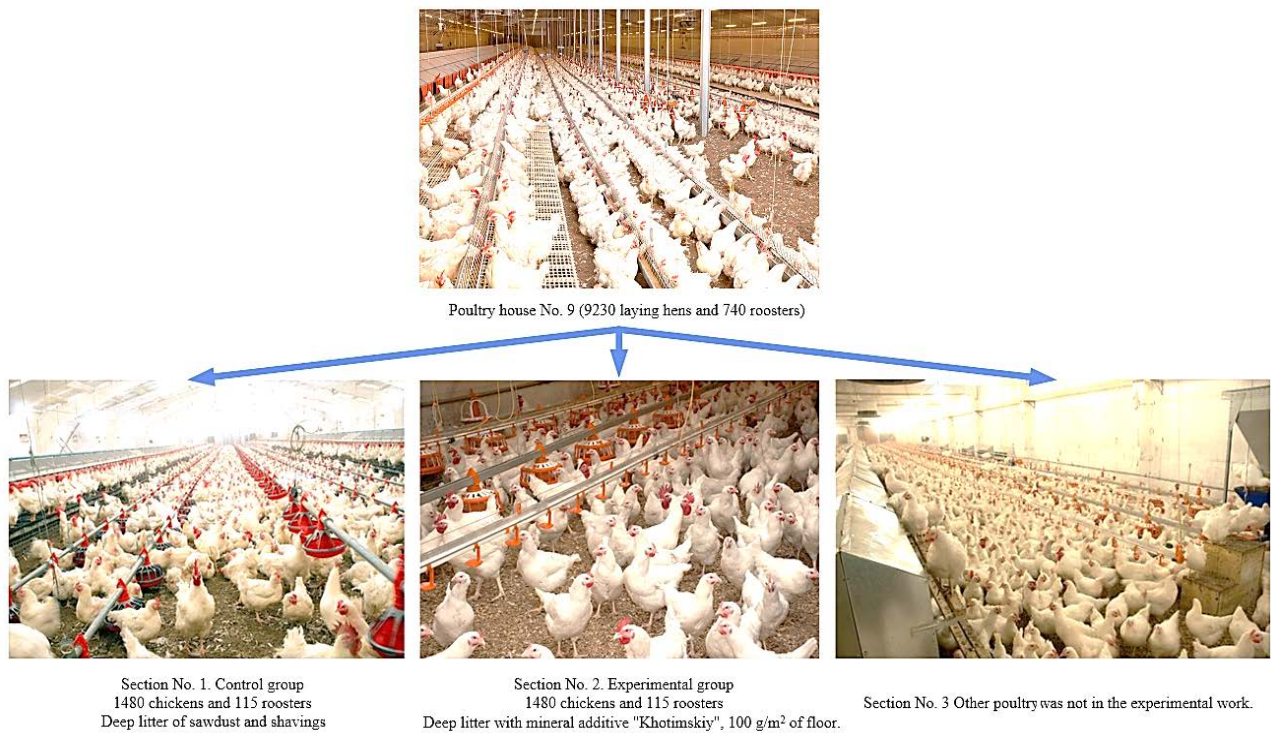


Figure 1: Experiment scheme

3 RESULTS AND DISCUSSION

The most common mycotoxins in feed raw materials were as test objects: from the group of aflatoxins - aflatoxin B1 (AB1), from the group of trichothecene - T-2 toxin (T-2), from the group of ochratoxins - ochratoxin A (OA), as well as Zearalenone (Zear). Mycotoxins were presented in the form of state standard solutions in the following concentrations: AB1 9.8 µg/ml, Zen 100.0 µg/ml, OA 9.2 µg/ml, T-2 100.0 µg/ml (Glaskovich et al., 2013). The amount of sorbent in contact with mycotoxins' initial solution is based on the calculated sorption capacity, which corresponds to 10 g/L of the initial solution of mycotoxins (1%). To determine the sorption force for mycotoxins, need to prepare solutions with concentrations of 2 MPC (maximum permissible concentration) (Kapitonova et al., 2012). Standard solutions of mycotoxins in the following volume were added to 20 ml of distilled water (pH 7.0): aflatoxin B1 8 µl, zearalenone 80 µl, ochratoxin A 88 µl, T-2 toxin 16 µl, which corresponds to the values of 2 MPC. The concentration of tripoli was 10 mg/ml. Control solutions: per 20 ml of distilled water (pH 7.0), the corresponding mycotoxin was added in the amounts indicated above. Ready solutions in closed test tubes were left on contact on a shooter for 20 minutes at room temperature. After incubation, 5.0 ml of the mixture was filtered through filter paper. The filtrate was used for research by the method of enzyme immunoassay (Nasonov, 2018).

Table 1: Adsorption capacity of tripoli in an acidic medium pH 3.4

Sorption activity	Sample concentration	Concentration in the sample after exposure, mg/kg	% sorption in the sample after exposure, mg/kg	Control (without sorbent)
Zearalenone	2 pdc (80 µl)	0.43	70.89	1.563
Aflatoxin	2 pdc (8 µl)	0.001	100	0.010
Ochratoxin A	2 pdc (88 µl)	0.065	100	0.762
T-2 toxin	2 pdc (88 µl)	0.42	75.79	1.000
Fumonisin	2 pdc (88 µl)	0.27	65.5	0.01
Deoxynivalenol	2 pdc (88 µl)	0.31	67.29	0.01

There had been established that the mineral additive "Khotimskiy" in an acidic environment had pronounced adsorption concerning aflatoxin, T-2 toxin, ochratoxin, sorbing these toxins by 87-100% (100% for aflatoxin). Adequate sorption capacity of 61-70% had been found for zearalenone, deoxynivalenol, and fumonisin (see Table 1).

When the pH of the medium changes from an acidic reaction to a neutral one, the sorption activity of the tripoli mineral decreases (see Table 2).

Table 2: The adsorption capacity of tripoli in a neutral medium pH 7,

Sorption activity	Sample concentration	Concentration in the sample after exposure, mg/kg	% sorption in the sample after exposure, mg/kg	Control (without sorbent)
Zearalenone	2 pdc (80 µl)	0.969	38	1.563
Aflatoxin	2 pdc (8 µl)	0.009	10	0.010
Ochratoxin A	2 pdc (88 µl)	0.512	33	0.762
T-2 toxin	2 pdc (88 µl)	0.775	32.5	1.000
Fumonisin	2 pdc (88 µl)	0.004	8	0.01
Deoxynivalenol	2 pdc (88 µl)	0.007	9	0.01

It has established that the use of tripoli (see Figure 2) as a sanitary means for drying bedding material when growing poultry helps to eliminate unpleasant odors and leads to a decrease in the number of bacteria and viruses of the Staphylococcus and Salmonella families, enterovirus, coronavirus, parvovirus, rotavirus. It scares off adult flies and destroys their larvae, suppresses fungi and mold.



Figure 2: Mineral additive «Khotimskiy».

This desiccant absorbs up to 200% of the liquid and disinfects the surface, reduces the air humidity in the poultry premises, and prevents ammonia and hydrogen sulfide from the droppings. The optimal dose is 100 g/m² of floor 2-3 times in the first week, then 100 g/m² one time per week constantly. The area around equipment for feeding and drinking needs 150 g/m² with a radius of about 2 m. The results of studying the litter material's moisture content, the thickness of the shell, and the acid number are in Table 3.

Table 3: The indicators controlled in the experience

Indicators	Section 1	Section 2
Litter moisture content, %	39.2	34.3
Shell thickness, mm (not <0.33)	0.36	0.35
Acid number, mg KOH / g (not > 5.0)	6.02	5.88

Analysis of the results indicates a positive effect of the mineral supplement. The moisture content of the litter material in the experimental section, in comparison with the control section,

decreased by 12.5% and amounted to 34.3%, which had a beneficial effect on the hygienic parameters of the microclimate when growing laying hens. Dry bedding for laying hens of the parent flock of the Ross-308 cross reduces the development of pathogenic and opportunistic microflora. It maintains optimal sanitary conditions in places of long-term keeping naturally.

The shell thickness indicator was practically at the same level. The thickness of the shell of laying hens of the parent flock must be at least 0.33 mm and not more than 0.40 mm. It is because too thin shells will contribute to a high rejection of eggs when breaking and notching are detected. Thus, too thick shell indicates a wrong balance of the diet and its price rise and a calcium excess. Thick shells harm the quality of the hatching egg. They can contribute to low heating of eggs during incubation, decreased oxygen-carbon exchange, low hatchability, and poor viability of day-old chicks. The obtained indicators in the experimental sections were within the normal range.

The average acid number of the yolk is no more than 5-6 (mg KOH)/g. Increasing yolk acid number serves as a test to determine the toxic dystrophy of poultry. It leads to a decrease in egg production, a reduction in hatching eggs' physical qualities, a decrease in hatchability, and death of embryos in the first days of incubation (30-45%) and when pecking (up to 20%). Juveniles hatched from eggs with increased yolk acidity with a minimum content of carotenoids are born weak, inactive, can hardly move, and die within the first ten days (up to 80%). In section 2, into deep litter was using the mineral additive "Khotimskiy" at a rate of 100 g/m² of the floor. The henchmen noted the pecking out of the particles of the mineral additive from the litter. The results of determining the acid number of an egg indicate a decrease of 2.3% (5.88 mg KOH/g). These dynamics can explain the beneficial effect of tripoli on birds' bodies, which is reflected in the quality of the incubation egg. At the same time, it should be noted that during the experimental work period, during the daily examination of the poultry of the meat production direction, it was found that the clinical and physiological state of the bird was normal. The poultry females did not note any stress factors or aggressive behavior of the birds during the Khotimskiy mineral supplement's addition.

Birds also had a standard rate of appetite, water, feed consumption, mobility, plumage, and legs' pigmentation. Feed consumption, preservation, and egg production were within the average statistic.

There was no decreasing bird productivity during the research work, according to one or another indicator. All of the above suggests that using the "Khotimsky" additive as a sanitary and hygienic means has a beneficial effect on the sanitary and hygienic indicator of poultry indicators.

4 CONCLUSION

Based on the research results on studying the effectiveness of the mineral supplement, it was found that tripoli is a useful adsorbent, normalizes the moisture content of the bedding material, which ensures optimal zoohygienic conditions for keeping birds.

The norm of using mineral additive "Khotimskiy" into deep litter is 100 g/m² floor. Its use contributes to an increase in the dryness of the litter material by 12.5%, a decrease in the acid number of the obtained products (eggs) by 2.3%, and also does not harm the gross productivity of laying hens of the parent flock and can be used (crumbled) in the presence of agricultural birds.

5 AVAILABILITY OF DATA AND MATERIAL

Data can be made available by contacting the corresponding author.

6 REFERENCES

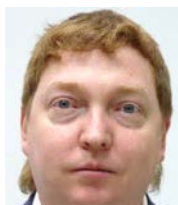
- Abraskova S.V. (2012). *Sanitary and hygienic importance of bacteria and molds in changing the quality of feed: study guide*. Vitebsk: VGAVM, 32.
- OST. (2003). *Chicken's Incubation Eggs*. OST 10321-2003, All-Russian Scientific Research and Technological Institute of Poultry, 20.
- GOST (2017). *Activated carbon. The standard method for the determination of adsorptive capacity for adsorbates at trace concentrations*. GOST 33587-2015, All-Russian Scientific Research Institute for Standardization of Materials and Technologies. 16.
- Beregovaya N.G. (2017). Results of using zeolites like NaX of the Orenburg gas chemical complex in poultry feed. *Bulletin of the Orenburg State Agrarian University*, 4(66), 244-247.
- Glaskovich, A.A., Abraskova, S.V., Kapitonova, E.A. (2013). *Mycological and bacteriological monitoring of feed safety*. Vitebsk, VGAVM, 224.
- Kapitonova, E.A., Glaskovich, A.A., Abraskova, S.V. (2012). Prevention of the action of mycotoxins in plant feed. *International scientific and practical. conf. dedicated to the 85th anniversary of the founding of the RUE "Scientific and Practical Center of the National Academy of Sciences of Belarus for Agriculture"*. Zhodino, 1, 302-304.
- Nasonov, I.M. (2018). Comparative sorption efficiency of drugs against mycotoxins in vitro. *Epizootology, immunobiology, pharmacology and sanitation*, 2, 77-81.
- Podobed, L.I., Stepanenko, A.N., Kapitonova, E.A. (2016). *Guide to the mineral nutrition of agricultural poultry*. Aquatoria. 360.
-



Professor Dr. Ivan Kochish is a Russian scientist in breeding, selection, genetics, and hygiene of poultry. Academician of the Russian Academy of Sciences. He holds a Doctor of Agricultural Sciences. He is a Candidate of Biological Sciences. His areas of research include Breeding, selection, genetics, and hygiene of poultry.



Elena Kapitonova is an Associate Professor at the Department of Private Livestock, Vitebsk Order of the Badge of Honor State Academy of Veterinary Medicine. She is a Candidate of Agricultural Sciences. Her research interests are the Development of Feed Additives, the Technology of Raising Animals (Birds), Feeding Farm Birds.



Ilya Nikonov is Deputy Director for Science and Development, BIOTROF LLC. Senior Researcher of the Scientific and Technical Information Department of the All-Russian Scientific Research Veterinary Institute of Poultry (VNIVIP), St. Petersburg. His research deals with the study of the intestinal microflora of poultry, feed, habitat. He is a developer of the composition and methods for assessing the effect of antimicrobial feed additives (probiotics, prebiotics, phytobiotics, etc.) and mycotoxin sorbents.



Professor Dr. Sergei Shlykov works at the Department of Technology of Production and Processing of Agricultural Products, Stavropol State Agrarian University, Russia. He holds a Doctor of Biological Science. His research focuses on Meat, Beef, Animal Products and Meat Products.



Ruslan Omarov is an Assistant of Profesor at the Department of Technology of Production and Processing of agricultural products, Stavropol State Agrarian University, Russia. He is a Candidate of Technical Sciences. His researches are Meat, Meat Products, Farm Animal Blood.