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ANALYSIS OF SOME FACTORS WHICH CONTRIBUTE TO NITRO INTOXICATION OF ANIMALS

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Abstract

The accumulation of nitro compounds in plants depends on several factors, in particular: the doses and frequency of incorporation of organic and mineral fertilizers in the soil, the amount of nitro compounds accumulated in soil and plants, climatic conditions, the period of plant physiological development, water insufficiency, etc. All of these factors contribute to the accumulation in quantities which exceed the admissible limit concentration (ALC) of nitro compounds in plants, including fodder. The main causes which contribute to the nitro intoxication of the animals are: the non-compliance of the rules on the storage and use of nitrogen fertilizers, the lack of zoo veterinary control over the quality of the fodder which contains amounts that exceed the ALC. The most sensitive to nitro intoxication are ruminants. The degree of nitrate hazard is mainly determined by the total toxicity of all metabolites formed in the fermentation process in the multi-chamber stomach of ruminant animals. Nitro intoxication of the animals occurs as a result of the penetration of nitro compounds into the body with food and drinking water which contain nitrites and nitrates that exceed ALC. The use of feed in animal ration, fodder and water with high nitrite and nitrate content leads to acute or chronic intoxication, which affects animal health and the quality of animal products.

Key words**:** *animals, nitro compounds, nitrite, nitrate, nitro intoxication*

INTRODUCTION

The accumulation of nitro compounds (nitrites, nitrates and nitrosamines) in plants adversely affects the quality of fodder crops, which often cause intoxication in mass of animals [6]. In case of irregular incorporation of fertilizers is possible to form in the soil, plants, human and animal body the increased content of nitro-compounds, which have a more pronounced toxicity and, most important, that it exhibits stronger cancerous, mutagenic and embryo toxic action [1], [5] [7]. The most sensitive to nitro intoxication are ruminant animals, to a lesser extent – those monogastric and poultry [8]. Acute nitro intoxication of cattle leads to an increase in the percentage of death, and at chronic nitro intoxication of cows there is a decrease in milk production, increase of abortions, the birth of unviable calves, increase the sterility percentage and the concentration of nitro compounds in milk [4].

Literary sources present the results of the influence of nitro intoxication on the process of sperm genesis at breeding bulls. It is mentioned that in case when into the body of bulls within 24 hours at the same time with feed and water penetrates the amount of 0.1 grams of nitrate ions (NO^3) per kilogram of body mass takes place an increase of the percentage of non-qualitative spermatozoa, and when into the organism penetrates a dose of 0.3 g/kg of body weight are obtained 100% of non-qualitative spermatozoa [8].

During nitro intoxication prophylaxis it is not necessary to use excessive doses of nitrogen fertilizers in the cultivation of crops; it is necessary to carry out feed quality analysis using the bio probe method, permanently to control the content of nitro compounds in the used feed; the dose of nitro compounds, taking into account their water content, must not exceed the permitted limit concentration ALC, for bulls - 0.1 g/kg, for other groups of bovine - 0.2 g/kg for sheep and horses - 0.4 g/kg for swine - 0.6 g/kg for rabbits and birds

-1.0 g/ kg of body weight [8]. If the amount of nitrate in the green feed is bigger than 0.2%, then it must be subjected to the insolubilisation process by not covering the pits for 2-3 days, it should be dried, processed into flour or left for obtaining seeds and used after diminishing the amount of nitro compounds [3], [8].

As a result of the research carried out by the collaborators of the Scientific and Practical Institute of Biotechnologies in Zootechny and Veterinary Medicine, it was found that at the incorporation in the soil under fodder crops of a high dose of mineral fertilizers, especially those with nitrogen, in case of some unfavourable climatic conditions for the physiological development of plants, excessive amounts of non-protein nitrogen (nitrates, nitrites and nitrosamines) are accumulated in them. Also, according to many researches, it was found that Moldova is a biogeochemical region with excessive accumulation of nitro compounds in groundwater and phreatic. This is explained by the intensive use of mineral fertilizers [1], [2], [7].

Taking into account the created situation regarding the pollution of the environment with nitro-compounds, it was necessary to study the factors that contribute to the nitro intoxication of animals, the methods of diagnosis, prophylaxis and treatment of this disease, and the influence of this disease on the quality of products of plant and animal origin [5].

Under favourable conditions of fermentation of fodder in the herbarium a large portion of nitrate in feed is transformed into ammonia and is used by intestinal micro organisms for protein synthesis. In some cases, nitro compounds and their disintegration products in long-term effects on the body of the animals cause health disorders, worsening the reproductive function, the birth of unviable youth, reduce of productivity and accumulation of nitro compounds in milk, organs and tissues of the animal body. In the animals' body, nitrates do not inactivate, but on the contrary, in the acid reaction they turn into nitrites, which are 10 times more toxic than nitrates. The intense transformation of nitrates into nitrites takes place during forage putrefaction, soil fodder pollution, manure and other substances rich in nitrifying bacteria. In the summer months, when the temperatures are 30 ° C - 40 ° C, at keeping the shredded green mass, for 1.5-2.0 hours, the content of nitrites increases by 3.33 times, from 30 mg/kg till/100 mg/kg [6], [8].

It is therefore necessary to take into account that the nitrate passage into nitrite occurs during inadequate feed storage, in separate cases and during breach of the technology rules of feed preparation and use of forage.

In blood nitrite it is associated with hemoglobin; forming methemoglobin. When converting 60% to 70% of hemoglobin into methemoglobin worsens the breathing of the tissues and occurs the danger of death of animals due to oxygen deficiency [8].

MATERIALS AND METHODS

The research was carried out within the Scientific and Practical Institute of Biotechnologies in Zootechny and Veterinary Medicine, being used as a biological material for research rabbits aged 3 months. In order to determine the influence of fodder crops with an increased content of nitro compounds on the nitro intoxication process of animals, an experiment was organized in which, according to the analogy principle, the animals were grouped in 4 lots (control lot- I and 3 experimental lots).In each lot, 8 rabbits were included (Table 1).

The duration of the experiment was 12 months. For the first 5 months in the feed ration of animals of the experimental lots was included alfalfa hay and water with increased nitrate content, and for the next 7 months the excess of nitro compounds according to the exposed doses in the experimental scheme was administered by mixing them with combine feed using potassium nitrate (KNO_3) for obtaining required dose per kilogram of body mass (g/kg mc). Rabbits in the control lot in both the first and the second part of the experiment were fed with regular feeds in which the nitro compound content did not exceed the ALC and those in the experimental lots were fed with forage and addition of

inorganic substances, in which nitro compounds were present in the doses listed in the table.

During the experiment the rabbits were subjected to observations of the physiological state and monthly was determined the body mass and collected samples of manure for analysis.

Table 1. Scheme of the performed experiment

Lot number	Number of animals	Experimental conditions: nitrate dose: g/kg body weight	Investigations during the experiment
I control	8	0.10 – 0.15	Nitrites and nitrates content was determined in alfalfa samples and in rabbit organs after sacrifice
II experiment	8	2.50	
II experiment	8	3. 00	
IV experiment	8	3.50	

Source: Own scheme.

In order to determine the role of nitro compounds in the nitro intoxication process of animals during the experimental period, the content of nitro compounds in the rabbit manure was determined and, after sacrifice, the content of nitro compounds was determined in tissues and organs.

RESULTS AND DISCUSSIONS

The obtained results regarding the correlation between the amount of nitro compounds in the ration and their elimination with the manure is exposed in Table 2.

Analyzing the obtained results, it was found that at the initial stage of the experiment the amount of nitro compounds in the rabbit manure of the control and experimental lots not differ essentially. At the end of the experiment, the amount of nitrite and nitrate has essentially changed. Thus, at the end of the experiment, in manure of the rabbits in the control group, the nitrite content increased 1.64 times and in the rabbits of experimental groups II, III and IV, it increased respectively 22.62 times, 10.33 times and 19.06 times. The same legality was also found regarding the content of the nitrates, which in the manure of the rabbits in control lot increased by 1.24 times, and in the rabbits of the experimental lots II, III and IV, respectively by 12.71 times, 5.51 times and 8.36 times, compared to their content at the initial stage.

By comparing the nitrite and nitrate content results in rabbit manure, from experimental lots with those of the control lot at the end of the experiment, essential changes were noted. The nitrite and nitrate content of the rabbit manure in the II, III and IV lots exceeded those of the respective control lot by 5.44 times, 4.59 times; 5.98 times and 4.42 times, 5.77 times and 6.39 times. Thus, the elimination of nitro compounds in the rabbit body depended on the dose of the administered nitro compounds and the period of administration.

Table 2. Nitrites and nitrates content in rabbit manure in the process of nitro intoxication

Lot number	Content of nitro compounds, mg / kg			
	Initial		After 12 months	
	Nitrites	Nitrates	Nitrites	Nitrates
I	3.3±0.02	34.0±0,03˙	5.4±0.02˙˙	42.3±0.03
II	1.3±0.01˙	14.7±0.02˙	29.4±0.02	186.8±0.04
III	2.4±0.01	44.3±0.03˙˙˙	24.8±0.01˙˙	244.0±0.02˙˙˙
IV	1.7±0.01˙˙	31.6±0.03˙˙	32.4±0.03˙	270.1±0.04˙˙

Note: The level of authenticity: ˙P≤0.05; ˙˙P≤0.01; ˙˙˙P≤0.001

Source: Own determination.

In order to determine the degree of nitro intoxication of the rabbits at the end of the experiment, after sacrifice, the content of nitro compounds was determined in the tissues and organs of the animals: muscle, liver, kidney (Table 3). From the data obtained in the results of the research it was found that the value of the nitrites in the muscles, liver and kidneys ranged between 0 and 10.7 mg / kg. In the organs of the animals in the control group nitrites were not detected, whereas in

the muscles, liver and kidneys of the animals in lots II, III and IV, their quantity oscillated respectively from 1.2 mg / kg - 1.8 mg / kg, 1.6 mg/ kg - 2.8 mg / kg and 8.8 mg / kg - 10.7 mg / kg.

Table 3. Content of nitrites and nitrates in tissues and organs of rabbits after the intoxication

Content of nitro compounds mg/kg	Lot number			
	I	**II**	**III**	**IV**
Muscle:				
a) nitrites	0.0 ±0.00	1.4±0.01	1.2±0.00	1.8±0.01
b) nitrates	5.2 ±0.00	17.7±0.01	25.7±0,02‴	30.9±0.01
Liver:				
a) nitrites	0.0±0.00	2.8±0.00	1.6±0.01	2.4±0.01‴
b) nitrates	5.4 ±0.01˙	64.4±0.03	74,1±0,02	86.4±0.03
Kidney:				
a) nitrites	0.0 ±0.00	10.7±0.02	8.8±0.02¨	10.6±0.01
b) nitrates	7.1±0.01	157.8±0.04‴	166.0±0.05‴	177.0±0.02¨

Note: The level of authenticity: ˙P≤0.05; ¨P≤ 0.01; ‴P≤0.001
Source: Own determination.

In experimental lots II, III and IV the nitrate content in the rabbit muscles exceeded respectively by 3.40 times, 4.94 times and 5.94 times that in the muscles of the animals in the control lot.

The same legality was also found in the nitrate content of animal liver in the experimental lots, where the nitrate content exceeded 11.93 times (lot II), 13.72 times (lot III) and 16.00 times (lot IV) the one in the liver of the animals of the control lot. The highest nitrate content was found in the kidneys of the animals of the experimental lots II, III and IV, where the value of nitrates exceeded ten times that of the rabbit kidneys in the control lot.

Thus, in the animals' kidneys in experimental lots II, III and IV, a quantity of nitrates was accumulated that exceeded that of the animals in the control lot, respectively by 22.22 times, 23.38 times and 24.93 times.

In the research results it was found that the nitro intoxication of animals is influenced by the dose and the period of use in nutrition of fodder and water with a high content of nitro compounds.

It was also found that the highest amount of nitro compounds was accumulated in the liver and kidney of animals that used a high dose of nitro compounds.

CONCLUSIONS

As a result of the research it was found that some of the factors that cause the nitro intoxication of the animals are the increased doses of nitro compounds that enter in the body and the period of use of fodder with a high content of nitrites and nitrates.

Nitro compounds are accumulated in the bodies that only partially are eliminated with manure.

Some of the nitro-compounds that enter in the animal's body are accumulated in large quantities in the muscle, liver and kidney.

Chronic nitro-intoxication of animals Influences negatively on the health and quality of products of animal origin.

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