THE ASSESSMENT OF NITRITE AND NITRATE CONTENT IN MIXED FEEDS AND EGGS IN RELATION TO THE PRODUCTION SYSTEMS (ORGANIC VS. CONVENTIONAL)

Maria Bologa[1*], I.M. Pop[1], Aida Albu[1]

[1]*University of Agricultural Sciences and Veterinary Medicine Iasi, Romania*

Abstract

The aim of this paper was the assessment of nitrate (NO_3^-) and nitrite (NO_2^-) content in the mixed feeds and eggs from two different production systems (organic and conventional). Were analyzed 40 samples of mixed feed and lay eggs from Brown hybrid at the age of 27 weeks in two units in Romania.

Sampling and the preparation of samples were performed in compliance with the rules of the standards in force in Romania and harmonized with EU legislation (SR 13175:1993); the method for the determination used was spectrophotocolorimetry method (UVmini 1240 SHIMADZU) .

Analysis of mixed feed samples revealed statistically significant differences ($p \geq 0.05$) between the two systems (organic vs. conventional) for the nitrate content but significantly distinct ($p \leq 0.01$) for nitrite content (0.49 vs. 1.71 ppm relative to a feed with a moisture content of 12%), values well below the maximum allowable 15 ppm provided by legislation in Romania.

In the case of the nitrate content of analyzed eggs, there were distinctly significant differences ($p \leq 0.01$) for whites samples (0.83 vs. 2.65 ppm fresh product) and mixtures samples (0.18 vs. 0.15 ppm fresh product) and statistically insignificant ($p \geq 0.05$) for yolk samples.

In the case of nitrite content of eggs from the two production systems were very significant differences ($p \leq 0.001$) (0.16 ÷ 0.27 ppm vs.0.06 ÷ 0.22 ppm fresh product).

Higher values of nitrite in eggs from organic systems may be due to access of poultry on grassy paddock and additional consumption of green fodder, its analysis revealed an average of 0.83 ppm at 12% moisture feed.

Key words: nitrate, nitrite, mixed feeds, eggs, organic, conventional

INTRODUCTION

Nitrites and nitrates are natural components of soil derived from mineralization of nitrogenous substance of vegetable or animal origin primarily due to existing into the soil of microorganisms.

Naturally between nitrites and nitrates from the soil, water and plant is establishes equilibrium which lead to intensive use in agriculture, of natural organic fertilizers or the synthetic nitrogen. Their degradation products enrich the soil accumulating in the crop at levels damaging to consumers.

Through feed and water nitrites and nitrates reach in animals and from here in human nutrition [2].

Based on a large amount of data, the nitrate content of organic and conventional crops has been compared. On average, the nitrate content of organic crops was 49% that of conventional crops [4].

Nitrite levels in food are very low (generally well below 10 mg/kg) and rarely exceed 100 mg/kg [3].

The aim of this study was to identify the nitrate and nitrite content and the comparative analysis of nitrate and nitrite content determined for samples of mixed fodder and lay eggs collected from two units in Romania with different systems in hens' egg production (organic and conventional),

*Corresponding author: mary_shoa@yahoo.com
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potentially toxic products reaching in the consumer body with plant products.

MATERIAL AND METHODS

During 2013 were taken 40 samples (mixed feed and lay eggs) from Brown hybrid at the age of 27 weeks in two units in Romania, the organic unit was located in Cluj County and the conventional unit was located in Barlad County.

Determinations were performed by standard spectrophotometric method [5], using the color developing solutions and sulfanyl amide N(naphtyl-1) ethylene diamine. This method consisted in dosing the concentration of nitrite in the sample by measuring the intensity of color formed by the reaction of nitrogen compounds diazotization of sulfanilic acid and nitrite from aqueous extract of the sample and the coupling with N(naphtyl-1) ethylene diamine.

Dosage of nitrate was made by reducing them to nitrites in the presence of metallic cadmium and determination of total nitrite. Nitrate concentration was obtained by the difference between total and the initial nitrite content, then the transformation of nitrate using the appropriate factor. The readings were performed at 538 nm from a UV-VIS Shimadzu UV mini 1240.

The results of analyzes were processed statistically by calculating the position and variation estimators (arithmetic average , respective the variance S^2, standard deviation s, standard deviation of average and coefficient of variation V%) and the significance of differences was determined using ANOVA Test: single factor.

RESULTS AND DISCUSSIONS

Analysis of mixed feed samples revealed statistically significant differences ($p \geq 0.05$) between the two systems (organic vs. conventional) for the nitrate content dar distinct semnificative ($p \leq 0.01$) for nitrites content (0.49 vs. 1.71 ppm relative to a feed with a moisture content of 12%), values well below the maximum allowable 15 ppm provided by legislation in Romania [1] (tab. 1).

Table 1 Nitrate and nitrite content of the analyzed mixed fodder from organic and conventional exploitation system of laying hens (ppm at 12% moisture feed)

Specification	Organic system (n=5)			Conventional system (n=5)		
	$\bar{X}$	$\pm s_{\bar{X}}$	V%	$\bar{X}$	$\pm s_{\bar{X}}$	V%
NO_3^-	28.22	0.28	2.24	18.60	0.18	2.17
NO_2^-	0.49[a]	0.02	8.05	1.71[c]	0.10	12.83

ANOVA: [ab]= statistically significant differences ($p \leq 0.05$) between samples; [ac]= distinct statistical significant differences ($p \leq 0.01$) between samples; [ad]= very Significant statistical differences ($p \leq 0.001$) between samples.

In the case of the nitrate content of analyzed eggs, there were distinctly significant differences ($p \leq 0.01$) for whites samples (0.83 vs. 2.65 ppm fresh product) and mixtures samples (0.18 vs. 0.15 ppm fresh product) and statistically insignificant ($p \geq 0.05$) for yolk samples.

In the case of nitrite content of eggs from the two production systems were very significant differences ($p \leq 0.001$) (0.16 ÷ 0.27 ppm vs.0.06 ÷ 0.22 ppm fresh product) (tab. 2).

Higher values of nitrite in eggs from organic systems may be due to access of poultry on grassy paddock and additional consumption of green fodder, its analysis revealed an average of 0.83 ppm at 12% moisture feed.

Table 2 Nitrate and nitrite content of the analyzed eggs from organic and conventional exploitation system of laying hens (ppm fresh product)

Part of egg	Specification	Organic system (n=5)			Conventional system (n=5)		
		$\bar{X}$	$\pm s_{\bar{X}}$	V%	$\bar{X}$	$\pm s_{\bar{X}}$	V%
White	NO_3^-	0.83^a	0.03	8.47	2.65^c	0.06	5.37
	NO_2^-	0.27^a	0.02	12.90	0.06^d	0.005	17.82
Yolk	NO_3^-	5.72	0.05	2.10	14.97	0.07	1.02
	NO_2^-	0.16^a	0.004	6.30	0.22^d	0.01	11.10
Mixture	NO_3^-	5.57^a	0.04	1.56	5.18^c	0.06	2.57
	NO_2^-	0.18^a	0.01	13.17	0.15^d	0.007	11.38

ANOVA: ^{ab}= statistically significant differences ($p \leq 0.05$) between samples; ^{ac}= distinct statistical significant differences ($p \leq 0.01$) between samples; ^{ad}= very Significant statistical differences ($p \leq 0.001$) between samples.

The statistical analysis of the values obtained for the content of NO_3^- of the organic grassland was an average of 377.64 ± 0.06 ppm at 12% moisture feed with limits within 377.46 and 377.78 ppm at 12% moisture feed; NO_2^- content of the organic grassland was a mean 0.83 ± 0.01 ppm at 12% moisture feed with limits between 0.8 and 0.86 ppm at 12% moisture feed, coefficient of variation of 0.3% and 2.87% shows us a character with high homogeneity (tab. 3).

Table 3 Nitrate and nitrite content of natural grassland ecological taken from exploitation system of laying hens (ppm at 12% moisture feed)

Specification	n	Statistical indicators calculated			The limits of variation	
		$\bar{X} \pm s_{\bar{X}}$	S	V%	min.	max.
NO_3^-	5	377.64±0.06	0.12	0.3	377.46	377.78
NO_2^-	5	0.83±0.01	0.02	2.87	0.8	0.86

ANOVA: ^{ab}= statistically significant differences ($p \leq 0.05$) between samples; ^{ac}= distinct statistical significant differences ($p \leq 0.01$) between samples; ^{ad}= very Significant statistical differences ($p \leq 0.001$) between samples.

Graphical representation of the percentage differences of nitrate and nitrite content of organic and conventional samples can be seen in fig. 1.

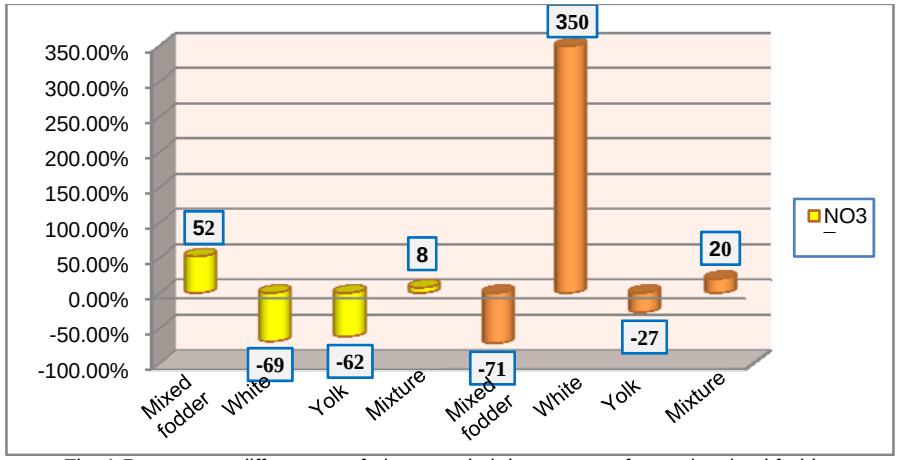

Fig. 1 Percentage differences of nitrate and nitrite content of organic mixed fodder and lay eggs to the conventional one (100%)

CONCLUSIONS

Evaluation of nitrites content in mixed fodder derived from both units, showed that the values obtained were below the maximum allowable limit of 15 ppm NO^{2-} in feed with a moisture of 12%, under the law in force in Romania.

Prohibition on the use of nitrogen fertilizer in organic production system may explain the lower concentration of mixed fodder these compounds analyzed in this system.

The obtained results are a quantitative database and are relevant for a certain period and important for the area from which samples were taken. They can be used to support some recommendations and measures to protect the animal health and the production.

It is recommended to continue monitoring the area and the fodders obtained to keep under control the accumulation of nitrite/nitrate by applying the necessary measures.

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