# THE EFFECT OF MANGANESE SOURCE ON NUTRITIVE AND BIOPRODUCTIVE INDICES AT BROILER CHICKENS

# EFECTUL SURSEI DE MANGAN ASUPRA INDICILOR NUTRITIVI ŞI BIOPRODUCTIVI LA PUII DE CARNE

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*In this experiment we studied the effect of chelated manganese from phosphatic glass soluble in acids, phosphatic glass semi soluble in water and phosphatic glass soluble in water and inorganic salts (Mn $SO_4$) on nutritive and bioproductive indices at broiler chickens. Mineral premix, made on calcium carbonate differentiate by manganese supplementation source, and was assured a level of 30.00 mg active Mn. The experiment was carried out on 120 broiler chickens divided in four experimental groups (CL-V1, EL-V2, EL-V3 and EL-V4), respectively 30 chickens per group. The hybrid used was Ross 308. The manganase assurance from phosphatic glass soluble in acids, phosphatic glass semi soluble in water and phosphatic glass soluble in water determine a decrease of manganese content in the poultry litter comparative with the manganese assurance from manganese sulfate. The manganese assurance from phosphatic glass soluble in water determines the increasing of the bioproductive indices with 5% comparative with the manganese assurance from manganese sulfate.*

**Key words**: chelated manganese, inorganic manganese, broilers, bioproductive indices

## Introduction

Is necessary to supplement the food with mineral premix adequate to every species and animal category, to prevent the metabolic disorders and to improve the bioproductive performances (Drinceanu et al., 2004; Luca et al., 2000)

Trace elements, especial manganese, are required in diets for poultry because they are important for growth, bone development, feathering, enzyme structure and function. They predominantly act as catalysts in many enzyme and hormone systems (Underwood and Suttle, 1999; Leeson and Summers, 1997; Liu et al., 1994). For many years adding minerals to animal feed has been related to addition of inorganic mineral sources, mostly in the form of sulphates, oxides and carbonates (Colins et al., 1999; Van Der Klis and Kemme, 2002).

The availability of manganese from these sources varies, but in general sulphates are thought to have higher bioavailability than oxides (Edwards, 1999).

The inclusion levels of manganese in feeds are based mostly on the NRC (1994) recommendations, but they are often criticized for not representing the needs of modern strains of commercial poultry (Leeson, 2003).

## Materials and Methods

In this experiment we want to follow the bioproductive effect of chelated manganese with different solubility degree from phosphatic glass administered to broiler chickens.

The experiment was carried out at the discipline of Animal nutrition and alimentation from Didactic Station Timisoara from eclosion to 42 days of age, on 120 broiler chickens divided in four experimental groups, respectively 30 chickens per group. The hybrid used was ROSS 308. The composition of sources used in the experiment is presented in Table 1. The source S13" is phosphatic glass with microelements without manganese, source Mn12 is phosphatic glass with manganese soluble in acids, source Mn11 is phosphatic glass with manganese semi soluble in water and source Mn10 is phosphatic glass with manganese soluble in water. The experiment organization scheme is presented in Table 2.

**Table 1.**

**The composition of sources used in the (mg/g)**

| Specification | S 13" | Mn 12 | Mn 11 | Mn 10 |
|---|---|---|---|---|
| Iron | 63.91 | 0 | 0 | 0 |
| Cupper | 6.80 | 0 | 0 | 0 |
| Zinc | 62.10 | 0 | 0 | 0 |
| Manganese | **0** | **300** | **150** | **50** |
| Cobalt | 0.98 | 0 | 0 | 0 |

**Table 2.**

**The experiment organization scheme**

| Period eclosion-3 weeks | | | |
|---|---|---|---|
| CL - V1 | EL – V2 | EL – V3 | E L– V4 |
| Combined forage 0-3 weeks+ mineral premix S 13" 35.00 g/100 kg CF + Mn 12 10.00 g/100 kg CF | Combined forage 0-3 weeks+ mineral premix S 13" 35.00 g/100 kg CF + Mn 11 20.00 g/100 kg CF | Combined forage 0-3 weeks+ mineral premix S 13" 35.00 g/100 kg CF + Mn 10 60 g/100 kg CF | Combined forage 0-3 weeks+ mineral premix S 13" 35.00 g/100 kg CF + Mn $SO_4$ 6.3 g/100 kg CF |
| Period 3-6 weeks | | | |
| CL - V1 | EL – V2 | EL – V3 | EL – V4 |
| Combined forage 3-6 weeks+ mineral premix S 13" 35.00 g/100 kg CF +Mn 12 10.00 g/100 kg CF | Combined forage 3-6 weeks+ mineral premix S 13" 35.00 g/100 kg CF + Mn 11 20.00 g/100 kg CF | Combined forage 3-6 weeks+ mineral premix S 13" 35.00 g/100 kg CF + Mn 10 60 g/100 kg CF | Combined forage 3-6 weeks+ mineral premix S 13" 35.00 g/100 kg CF + Mn $SO_4$ 6.3 g/100 kg CF |

The quantity of mineral premix supplemented in the forage is presented in Table 3. The requirements of chickens for microelements presented in Ross technological guide (2005) are: iron 80mg, cupper 8 mg, zinc 60-80 mg, manganese 100 mg, molybdenum 1 mg, iodine 1 mg, selenium 0.10-0.15 mg. After Drinceanu and al. (2004), the level of microelements can be reduced with 50% because of the increased availability of phosphatic glasses comparative with inorganic salts.

In the structure of combined forages fed to chickens from experimental groups was incorporated mineral premix in percentage of 0.5%, made by specific technologies (Ştef, 2002). The microelements were incorporated in the structure of combined forage by a mineral premix 0.5% in which they were fixed on calcium carbonate.

The mineral premix, fixed on calcium carbonate was differentiating by the source of manganese and they assured a level of 30.00 mg active manganese, according to experimental scheme. In table 3 are presented the structure of mineral premix used in experiment, respectively the chelated microelements quantity used in 0.5 kg of mineral premix for 100 kg combined forage.

**Table 3.**

**The structure of mineral premix 0.5% used in micromineral supplementation of chickens from experimental groups**

| Source | **CL – V1** | **EL – V2** | **EL – V3** | **EL – V4** |
|---|---|---|---|---|
| S 13” | 35.00 | 35.00 | 35.00 | 35.00 |
| Mn 12 | 10 | - | - | - |
| Mn 11 | - | 20 | - | - |
| Mn 10 | - | - | 60 | - |
| Manganese sulfate ($Mn\ SO_4$) | - | - | - | 9,3 |
| Potassium iodide (KI) | 0.013 | 0.013 | 0.013 | 0.013 |
| *Sodium selenite* ($Na_2SeO_3$) | 0.033 | 0.033 | 0.033 | 0.033 |
| Calcium carbonate ($CaCO_3$) | 454.954 | 444.954 | 404.954 | 455.654 |
| Total | 500 | 500 | 500 | 500 |

## Results and Discussions

In this experiment were establish the following nutritive and bioproductive indices: forage consumption, weight gain, specific consumption. The combined forage administrated was weight daily and at the end of each period was weight the forage unconsumed. The weight gain was established by weighing at eclosion, 21 days and 42 days.

The statistical processing of data obtained from experimental groups was made with the Mann Witney U test from Statistica program.

In table 4 are presented the forage consumption, the evolution of body weight, the evolution of weight gain and the evolution of specific consumption at chickens from experimental groups.

**Table 4.**

**The forage consumption, the evolution of body weight, the evolution of weight gain and the evolution of specific consumption at chickens from experimental groups**

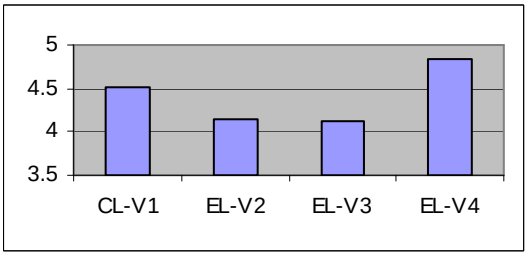
| Specification | CL – V1 | EL – V2 | EL – V3 | EL – V4 |
|---|---|---|---|---|
| Consumption on period/chicken (kg) | 4.51 | 4.14 | 4.13 | 4.85 |
| Medium daily consumption/chicken/ period (g) | 107.38 | 98.57 | 98.33 | 115.47 |
| Percentage differences | **100** | **91.79** | **91.57** | **107.53** |
| Weight at 42 days (g) | 2225.23±67.74 | 2239.56±57.13 | 2337.71±100.95 | 2207.33±40.10 |
| Variability coefficient | 10.98 | 10.20 | 16.16 | 7.71 |
| Percentage differences | **100** | **100.64** | **105.5** | **99.19** |
| Statistical significance | | **NS** | **NS** | **NS** |
| Total weight gain/ period / chicken (g) | 2186.23 | 2200.56 | 2298.71 | 2168.33 |
| Medium daily gain/ period (g) | 52.05 | 52.39 | 54.73 | 51.62 |
| Percentage differences | **100** | **100.65** | **105.14** | **99.18** |
| Specific consumption (kg forage / kg gain) | 2.06 | 1.88 | 1.79 | 2.23 |
| Percentage differences | **100** | **91.26** | **86.89** | **108.25** |

NS = p > 0.05 * p = < 0.05 ** p = < 0.01 *** p= < 0.001

From Table 4 data and graphic 1 come off the following conclusion regarding to forage consumption:

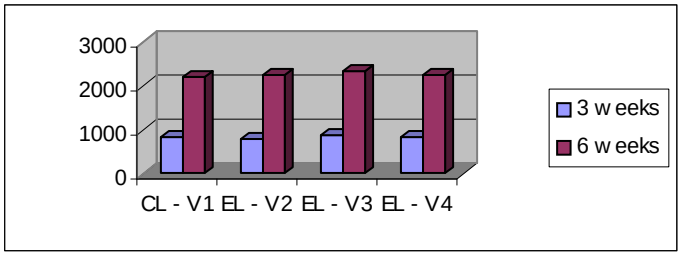
- at experimental group EL – V2 the forage consumption was lower with 8.21% comparative with the control group on the entire experimental period;
- at experimental group EL – V3 the forage consumption was lower comparative with the control group with 8.43%;
- at experimental group EL – V4 the forage consumption was greater with 7.53% comparative with the control group on the entire experimental period.

At all experimental groups the forage consumption data are comparable with the control group and the differences are not significant, the smallest forage consumption was registered by EL-V3 at which the forage consumption was with 8.43% lower comparative with the control group.




**Graphic 1.** The forage consumption at chickens from experimental groups

From Table 4 data and graphic 2 it may be seen that at 6 weeks the EL-V3 registered the highest body weight with 4.86-6.31% higher comparative with the others experimental groups.




**Graphic 2.** The evolution of body weight at chickens from experimental groups

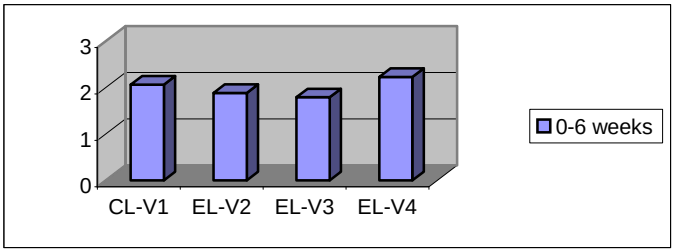
Datas from Table 4 and graphic 3 shown:

- during entire growth period (0-6 weeks) the highest daily weight gain was registered by EL-V3 with 54.73 g followed close by CL-V1 with 52.39 g; the smallest daily weight gain was registered by experimental group EL-V4 with 51.62 g.


**Graphic 3.** The evolution of daily weight gain at chickens from experimental groups

From Table 4 and graphic 4 it can be seen:

- during the entire growth period the smallest specific consumption was registered by EL-V3 with 13.11% smaller than control group.




**Graphic 4.** The evolution of specific consumption at chickens from experimental groups

Were taken samples from the two structures of combined forage to determinate the manganese content before adding the mineral premix. Also at the end of each experimental period were taken litter samples from the experimental groups in order to dosing the manganese content. DM was determinate by drying at 105 $^{o}$C and the samples were burned at 700$^{o}$C to obtain the ash. The determination of manganese from the samples was made with the spectrophotometer with atomic absorption. The method has at base the fact that the radiation emitted by a lamp with cavity cathode is absorbed proportionally with the atoms concentration of mineral microelement of an atomic cloud.

In table 5 are presented the results obtained after dosing the manganese content from combined forage, deposit organs and litter.

**Table 5.**

**The manganese content from combined forage, deposit organs and litter (mg/kg DM or ash*)**

| Specification | CL-V1 | EL-V2 | EL-V3 | EL-V4 |
|---|---|---|---|---|
| Combined forage 0-3 weeks | 14.74 | 14.74 | 14.74 | 14.74 |
| Combined forage 3-6 weeks | 11.59 | 11.59 | 11.59 | 11.59 |
| Liver | 17.45±0.71 | 16.34±1.78 | 20.65±5.11 | 16.06±0.45 |
| Percentage differences | **100** | **93.63** | **118.34** | **92.03** |
| Tibia* | 4.34±0.73 | 3.25±0.32 | 3.96±0.35 | 2.49±0.61 |
| Percentage differences | **100** | **74.88** | **91.24** | **57.37** |
| Litter 0-3 weeks | 63.43 | 66.93 | 68.24 | 74.36 |
| Percentage differences | **100** | **105.51** | **107.58** | **117.23** |
| Litter 3-6 weeks | 65.43 | 67.49 | 67.30 | 71.03 |
| Percentage differences | **100** | **103.14** | **102.85** | **108.56** |

## Conclusions

The introduction of chelated manganese with different solubility degree in the structure of combined forage destined to broiler chickens has the following effects:

The forage consumption data are comparable at all experimental groups with the data obtained by control group because the differences are not very large. The

smallest specific consumption was registered by EL-V3 of 4.13 kg combined forage/chickens/period to which the consumption was with 8.43% smaller than control group, the last registered a consumption of 4.51 combined forage/chickens/period.

The body weight in the case of EL-V3 was higher comparative with the control griup with 5.50% but was not statistical assured (p0.05).

The specific consumption is similar to all experimental groups. The smallest specific consumption was registered by EL-V3 with 13.11% smaller than control group. The highest specific consumption was registered by EL-V4 with 8.25% higher than control group.

The smallest level of manganese was registered by EL-V2 of 16.34±1.78 mg/kg DM comparative with experimental group EL-V3, the last registered a level of 20.65±5.11 mg/kg DM with 18.34% higher than control group. For control group the manganese content of tibia was of 4.34±0.73 mg/kg DM and was the higher registered value. The smallest level of manganese in the tibia was registered at EL-V4 of 2.49±0.61 mg/kg DM with 42.63% smaller than control group.

The assurance of manganese from phosphatic glass soluble in acids, phosphatic glass semi soluble in water and phosphatic glass soluble in water determine the reduction of manganese content from poultry litter comparative with the assurance of manganese from manganese sulfate.

The assurance of manganese from phosphatic glass soluble in water determine the obtaining of superior bioproductive indices at broiler chickens comparative with the assurance of manganese from phosphatic glass semi soluble in water, soluble in acids or manganese sulfate.

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