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Original Paper

Effects of dietary micronutrient supplementation on the reproductive traits of laying geese

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A feeding trial was conducted with two breeder flocks of Hortobágy White goose to evaluate the possible effects of a micronutrient preparation (containing essential amino acids, vitamins and trace elements) on their reproductive traits. One flock (864 layers + 209 ganders) served as a control, and the other (731 layers + 218 ganders) as a treated group. The micronutrient preparation was given in the drinking water to the treated group in a single daily dose of 50 g per 500 kg live weight 10 days before the onset of the laying period, and thereafter at 10-day intervals for 10 days on each occasion, until the end of the laying period (lasted from 1st February until 26th May, 2014). Treated geese laid consistently more eggs at a higher rate of laying intensity than controls from the 3rd laying week, resulting in a higher average production per layer (44 vs. 35 eggs) and a higher average laying intensity (38.0 % vs. 30.0 %). The comparable hatching results of eggs from treated and control geese indicated that the micronutrient preparation has not affected egg fertility (93.0 % vs. 93.5 %), hatchability of incubated eggs (89.0% vs. 88.0%), and the hatch rates (72.0–72.0 %). The mortality rates over 17 laying weeks were relatively low both in the treated (7.7 % of layers; 5.5 % of ganders) and control groups (5.1 % of layers; 6.2 % of ganders).

Keywords: goose, micronutrient, egg laying, egg fertility, hatchability

1. Introduction

The goose possesses a good adaptability to free range or grazing (Romanow, 1999) and it is also “ideally suited to sustainable production practices” for its rapid growth rate, large consumption of high fibre feedstuffs and easy management (Buckland and Guy, 2002). Geese are mainly produced for meat – being of high dietary quality (Romanov, 1999) – but their fattened liver and feathers are also valuable products. Nevertheless, the total number of eggs laid per year by geese is very low compared to many other poultry species; not exceed 30–50 pieces for most breeds even under good management conditions (Buckland and Guy, 2002) – as the laying period is highly seasonal under natural lighting conditions (Zeman et al., 1990; Rosinski et al., 1996; Shi et al., 2008).

Timing and duration of egg production can be affected by genetic selection, cross-breeding, using artificial light and improved nutrition. The most important factors in goose production are the management and feeding of the breeder flock, since these can mainly impact the reproductive rate, including the number of eggs laid, percent fertility, percent hatch, and hence the number of goslings produced per goose (Buckland and Guy, 2002).

This has prompted us to evaluate the effects of dietary supplementation with a corroborant micronutrient preparation (containing essential amino acids, vitamins, and trace elements) on the reproductive traits of laying geese kept in the Hortobágy Goose-Breeding Zrt.

2. Materials and methods

The used corroborant micronutrient preparation contained amino acid monosodium glutamate 1.5 %, lysine 20 %, and methionine 35 %; vitamins B_2, B_6 and C; and trace mineral zinc 520 mg as zinc sulphate [E6], manganese 480 mg as manganese sulphate [E5], copper 360 mg as cupric sulphate [E4], iodine 19 mg as potassium iodide [E2], and cobalt 4 mg as cobalt carbonate [E3]. The technological additives included emulsifier [E484], tartaric acid [E334], and aerosil [E551 b]. The vehicle was dextrose.

The feeding trial was carried out in 2014 with two adult breeder flocks of “Hortobágy White” goose that comprised about 40 % of the breeder stock kept in the farm of the Hortobágy Goose-Breeding Zrt. They were kept in a deep litter system with access to a yard and fed *ad libitum* with commercial granulated feed for geese (Table 1) during the term of breeding. Drinking water was always available.

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Table 1 Nutrient composition of the commercial laying feed and the minimum requirement of nutrients

Nutrient	Unit	Laying feed	
		Commercial*	**Min. requirement****
Dry matter	%	89.0	86.0
Crude protein	%	15.8	15.5
ME	MJ kg^{-1}	10.7	11.5
Crude fat	%	2.4	–
Crude fibre	%	5.0	5.0
Lysine	%t	0.8	0.8
Methionine	%	0.4	0.35
Ca	%	3.4	2.5
P	%	0.6	0.6
Na	%	0.16	0.14
Zn	mg kg^{-1}	100.0	70.0
Vitamin A	IU	12800.0	12000.0
Vitamin D3	IU	4000.0	2500.0
Vitamin E	mg kg^{-1}	135.0	15.0

Source: *NAGISZ Zrt. **Hungarian Feed Codex, 1992

The flocks were kept in two separate goose sheds (of 600 m^2 floor) with runs (of 700 m^2 area) under natural daylight, air temperature and relative air humidity. Variation in the climatic factors is shown in Figure 1.

The micronutrient preparation was given to the treated group in the drinking water in a single daily dose of 50 g per 500 kg live weight 10 days before the onset of egg-laying, and thereafter at 10-day intervals (for 10 days on each occasion) until the end of the laying period (i.e., from 1st February till 26th May, 2014).

Geese were daily observed for general health and possible deaths. Eggs (intact + defected) produced per groups were daily recorded and cumulated for each laying week. The laying curves were obtained by relating the weekly egg production to the actual number of layers, and laying intensity was calculated.

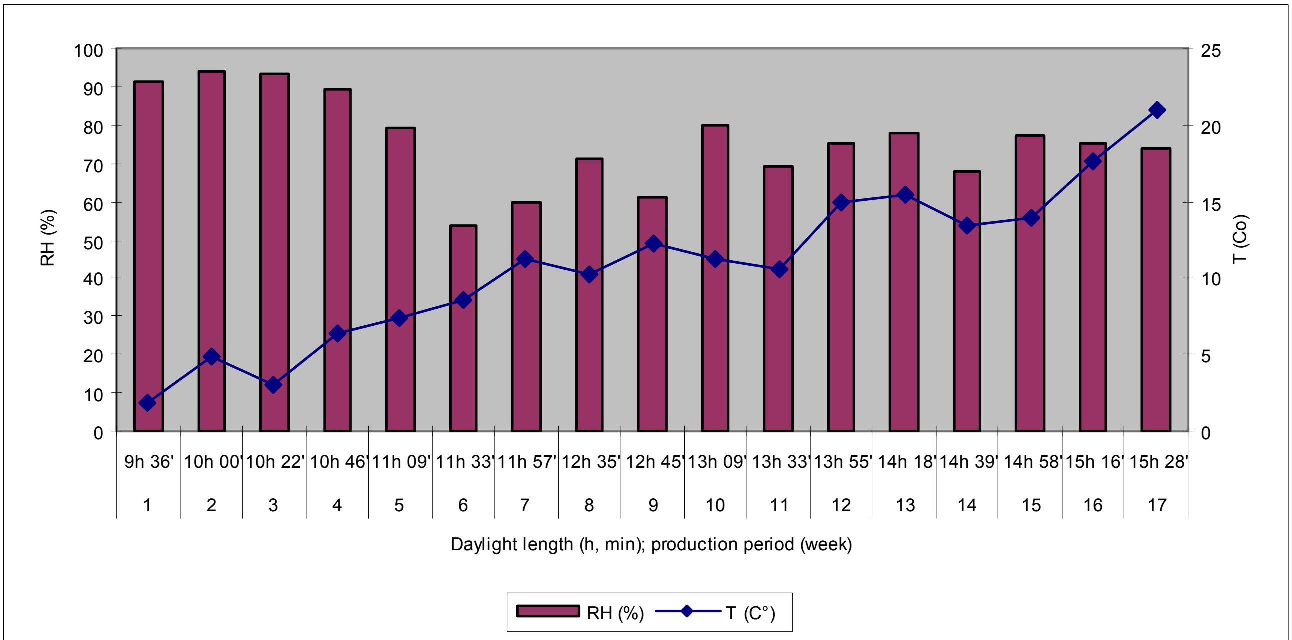

Figure 1 Variation in the climatic factors during the egg production period
Source: OMSZ, Hungarian Meteorological Service

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Table 2 Effect of dietary supplementation with the micronutrient preparation on the reproductive traits of geese

Trait	Control group	Treated group
Initial number of layers (head)	864	731
Initial number of ganders (head)	209	218
Eggs laid per layer (piece)	35	44
Egg laying intensity in %*	30.0 ± 12.0	38.0 ± 16.0
Eggs candled out in %*	12.0 ± 3.0	11.0 ± 5.0
Egg fertility in %*	93.5 ± 4.0	93.0 ± 3.0
Hatchability in %*	88.0 ± 3.0	89.0 ± 5.0
Hatch rate in %*	72.0 ± 5.0	72.0 ± 7.0

* – mean ± SD

Apparently intact eggs collected over 7 days were set in an incubator for 28 days and thereafter transferred into the hatchery compartment for the last 2 days. The number of infertile, bloody or rotten eggs at 7 day candling, and that of viable goslings hatched were recorded per each hatch.

Statistical analysis of the data included variance analysis, the Student's *t*-test; the correlation of laying intensity with daylight length was determined by simple regression analysis (Sváb, 1981).

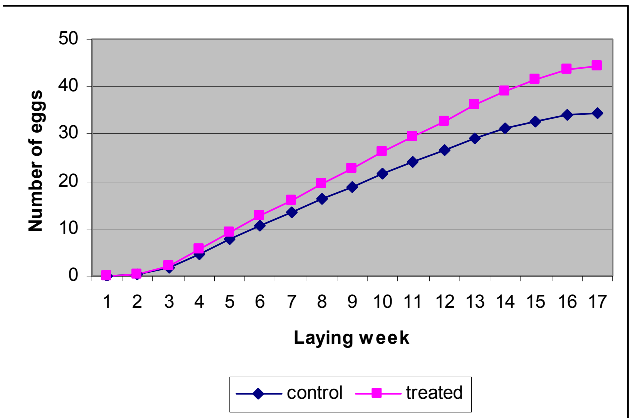

Figure 2 Cumulative egg production of geese in peace goose^{-1}

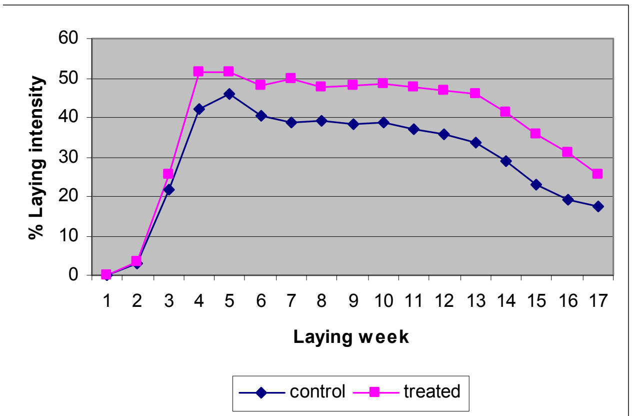

Figure 3 Egg laying intensity of geese in %-1

3. Results and discussion

During 17 laying weeks, the mortality rates showed little differences between the treated (7.7 % of layers; 5.5 % of ganders) and control (5.1 % of layers; 6.2 % of ganders) groups.

On totals of 30.790 eggs were obtained from the treated and 28,899 eggs from the control geese (percentage of defected eggs was 3 % and 4 %, respectively). Treated geese laid consistently more eggs (Figure 2) at a higher rate of intensity (Figure 3) than controls from the 3rd laying week, resulting in a higher average production per layer (44 vs. 35 eggs) and a higher average laying intensity (38.0 % vs. 30.0 %), respectively (Table 2). Laying intensity in both groups varied in week positive correlation with daylight length (r_t = 0.32; r_c = 0.15).

On totals of 16.520 and 13.140 eggs from the treated and control groups, respectively, were hatched over 8 hatches. There was little difference between treated and control geese in the hatching results (Table 2), notably in the percentage of candled (infertile + bloody + rotten) eggs (11.0 % to 12.0 %) thus in egg fertility (93.0 % to 93.5 %) and in the potential hatchability of incubated eggs (89.0 % to 87.0 %), and the hatch rates were identical (72.0 % to 72.0 %).

The Hortobágy White goose is a state recognised breed that can produce 40–50 eggs during the spring laying-cycle under semi-extensive system. In the present feeding trial, the average production of 40 eggs per layer by the treated group has fallen in this range, whilst the average production of 35 eggs per layer by the control group was below the lower limit of the range. The better production of the treated geese was mainly due to the corroborative effect of the dietary supplementation with the micronutrient preparation.

The hatchability of eggs from the breed varied between 76.0 % to 78.0 %, expressed in percent of the number of eggs incubated. In the present feeding trial, the hatchability of eggs was above this range in both the

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treated and control groups, notably 89.0% and 88.0 %. Based on the comparable hatching results of the control and treated groups, the dietary supplementation with the said nutrient preparation has not affected significantly egg fertility, hatchability or the hatch rates in geese. In our another experiment conducted on Lippitsch geese under intensive system, the micronutrient supplemented group produced only one egg more (41–40) per goose than the control but their eggs had higher fertility (87.0 % vs. 82.0 %) and hatching rate (59.0 % vs. 56.0 %) during the last third part of the laying period (Tóth et al., 2015).

There is little published data on the effects of dietary nutrient or non-nutrient supplementation on goose reproduction. The higher levels of dietary protein resulted small increases in egg production and egg weight in hens (Proudfoot et al., 1988); the supplementation of the layer diets with methionine, lysine and/or vitamin C did not influence significantly egg production (Amaefule et al., 2004). In a recent experiment, dietary supplementation with thyme and rosemary grist has improved egg production and hatchability of eggs with breeder geese (Weber et al., 2013).

4. Conclusions

The dietary supplementation with the micronutrient preparation has improved egg production and laying intensity in the breeder geese, but failed to improve egg fertility and the hatch rates of goslings.

5. Acknowledgments

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