ISSN 1682-8356
ansinet.org/ijps

INTERNATIONAL JOURNAL OF

POULTRY SCIENCE

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International Journal of Poultry Science 13 (12): 709-713, 2014
ISSN 1682-8356

Variation in Laying Traits of Hortobagy White Breeder Geese by Year and Age

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Abstract: Daily egg production data for four breeder flocks of Hortobagy White geese recorded in 2012 and 2013 were analyzed. Flock age ranged from one to five years. The flock size differed considerably within and between years. The flocks were formed one month before the laying period and housed separately in sheds with deep litter system and yard access and given a granulated laying feed throughout the laying period. They were maintained under natural daylight, air temperature and relative air humidity. The laying traits analyzed per flock per week were the number of eggs per goose and laying intensity related to the number of surviving geese. The onset of egg laying differed by year and age: in 2013 it occurred three weeks and four weeks earlier in the one-year old and elder flocks, respectively, than in 2012. With one-year old flocks, the laying period lasted for 15 weeks in 2013 and for 18 weeks in 2012, with the elder flocks it lasted for 20 and 21 weeks, respectively. The laying traits also differed by year but generally improved with the age, irrespective of the year. Geese produced 28-35 eggs in their first year of lay, 45-56 eggs in their second year, 51-42 eggs in their third and fourth years and 43-45 eggs in their fifth years. The laying intensity was 27-28% in the first year, 31-40% in the second year, 36-29% in the third and fourth year and 30-32% in the fifth year.

Key words: Age, goose, egg production, laying intensity, year

INTRODUCTION

Geese are kept almost worldwide due to their rapid growth rate (Leeson and Summers, 1997), good adaptation to free range or grazing (Romanov, 1999) and easy management (Buckland and Guy, 2002). The main products from geese are meat, fattened liver and, down and feathers.

Unlike other domestic poultry species, geese are not prolific egg producers; most breeds lay only 30-50 eggs a year (Buckland and Guy, 2002). Geese lay eggs, most frequently, every second day (Schneider, 1995; Romanov, 1999; Kent and Murphy, 2003) in contrast to hens (Miandmiets *et al*., 1993), turkeys and ducks (Simmons and Hetzel, 1983; Pyrzak and Siopes, 1989) laying one egg every day. Further, geese are seasonal breeders under natural lighting conditions (Rosinski *et al*., 1996; Zeman *et al*., 1990; Shi *et al*., 2008). At European latitudes, the initiation of re-growth of reproductive organs occurs just after the shortest day, around the end of December and the first eggs geese lay in mid-January, depending on ambient temperature (Huang *et al*., 2012). These geese finish laying in June (Sauveur, 1982; Shi *et al*., 2008).

The long-lived geese show a natural increase in reproductive performance with age. Egg production, fertility and hatchability are higher in the second and subsequent years than in the first year of production (Merritt *et al*., 1960; Merritt and Lemay, 1963). Geese usually produce 25-35 eggs in their first year of lay, 40-50 eggs in their second and third years, 50 eggs in their fourth and subsequently egg production starts to decline (Labatut, 2002). In production practice they are kept for three to five laying seasons (Bogenfürst, 2004). In this paper laying traits of Hortobagy White breeder geese (a state-recognised meat-type breed) kept under semi-extensive system at the Tiszababolna premises of the Hortobagy Goose Breeding Zrt. in Hungary are analyzed by year and age.

MATERIALS AND METHODS

Daily egg production data recorded for four breeder flocks of Hortobagy White geese in 2012 and 2013 were analyzed (Table 3). The geese (hatched in May-June 2007, 2008, 2010, 2011 and 2012) were in their first to fifth year of lay. The flock size differed considerably within and between years.

The flocks were formed in November and housed in separate sheds with deep litter system and yard access. They were given a granulated laying feed (Table 1) from one month before and throughout the laying season. The birds were maintained under natural daylight, air temperature and relative air humidity (Table 2). After termination of laying all flocks were kept on pastures until the next November.

Geese were vaccinated against fowl cholera, Derzsy disease and *E. coli*. They were observed daily for general health state and the number of dead geese recorded. Egg production per flock was recorded daily. The number of eggs per flock per week was divided by the number of surviving geese of each flock to obtain the average number of eggs produced per goose (following a study conducted on Egyptian geese, Gamal and

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Kamar, 1962) and laying intensity (that is closely correlated with the rhythm of egg laying, Rosinski *et al.* 1996) was calculated [(number of eggs per geese) per 7 x 100]. For comparison, cumulative weekly egg production and laying curves were drawn.

The production and climatic variables were statistically processed (Microsoft Office Excel 2003, SP3) using analysis of variance and Student's t-test to test the significance of the between-year and between-age differences in the means; the pairwise correlation coefficients for the selected variables were calculated by simple regression analysis (Svab, 1981).

RESULTS

The Hortobagy White Goose breed can produce about 35-50 eggs in one cycle of lay depending on the year according to previous experience.

Although day-lengths (the time between sunrise and sunset) agreed through the calendar weeks in both years air temperature was lower and relative humidity was higher in 2013 than in 2012 (Table 2) as shown by the degree of their negative correlation (r_{2012} = -0.31; $p>0.10$; r_{2013} = -0.67, $p<0.001$).

The laying traits of the goose flocks differed by year and age (Table 3). With one-year old flocks, the laying period started in 2013 three weeks earlier and terminated three weeks earlier than in 2012; the laying duration comprised 15 and 18 weeks, respectively. With two to five year old flocks, the laying period began in 2013 four weeks earlier and finished one week earlier compared to 2012; the laying duration comprised 20 and 21 weeks, respectively.

In 2012, the one-year old flock laid 7 eggs more per goose and had 1% higher laying intensity (with 13% lower mortality rate) than that in 2013; with elder flocks total egg yield was 8 eggs more per goose with 6% higher laying intensity (and 7% lower mortality rate) in 2013 compared to 2012 (Table 4, Fig. 1a,b-2a,b). In one-year old flocks, laying intensity in 2012 and 2013, respectively, increased until week 4 and 7, reaching a plateau (of 44 vs. 40%) that was maintained throughout weeks 5-11 and 8-12 and then decreased (Fig. 2a). In elder flocks laying intensity in 2012 and 2013 increased until week 5, maintaining a plateau (of 41 vs. 42%) throughout weeks 6-15 and 6-13, respectively and then decreased (Fig. 2b). Based on the degree of laying intensity the laying period could be divided into a rapid increase, a plateau and a rapid decrease phase, similarly to the findings of Salamon and Kent (2013) meanwhile day length increased consistently. The correlation of laying intensity with day length was therefore positive until the decrease phase and thereafter negative (Table 4). The correlation was similar but weaker with air temperature, except for the decrease phase being weak positive in the one-year old flock in 2013 (Table 5).

Table 1: Components of the commercial laying feed and the minimum requirement

		------- Laying feed for geese -------	
Component	Unit	Commercial*	Minimum requirement**
Dry matter	%	89.0	86.0
Crude protein	%	15.8	15.5
ME	MJ/kg	10.7	11.5
Crude fat	%	2.4	
Crude fiber	%	5.0	5.0
Lysine	%	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	100.0	70.0
Vitamin A	IU	12800.0	12000.0
Vitamin D_3	IU	4000.0	2500.0
Vitamin E	mg/kg	135.0	15.0

Source: *NAGISZ Zrt (2012); **Hungarian Feed Codex 90' (2011)

The laying traits improved with the ageing of geese (Table 3). Over the two successive years the geese produced 28-35 eggs in their first year of lay, 45-56 eggs in their second year, 51-42 eggs in their third and fourth years and 43-45 eggs in their fifth year. The corresponding figures for laying intensity were 27-28% in the first year, 31-40% in the second year, 36-29% in the third and fourth year and 30-32% in the fifth year.

DISCUSSION

In the Hortobagy White breeder flock kept under natural daylight, air temperature and relative air humidity, egg production is restricted only to one season coinciding with the increasing day length.

The onset and duration of egg laying hence the egg production indices revealed between-year differences in both the one-year old and elder goose flocks.

The lower egg yield of the one-year old flock in 2013 can be attributed to its shorter laying season and much higher mortality rate-as an aftermath of selecting this flock from a population smaller than usual, since major proportion of hatching eggs produced in 2012 was sold. The better performance of the elder flocks in 2013 can partly be reasoned by their better age structure (two, three and five-year old) compared to 2012 (two, four and five-year old). Further, they were re-stocked meanwhile culling individuals of poor body conformation-resulting in their lower mortality rate.

In good agreement with previous reports the laying traits of the goose flocks improved with the age (Merritt *et al.*, 1960; Merritt and Lemay, 1963; Labatut, 2002; Salamon and Kent, 2013), irrespective of the year. Notably, the elder flocks came into production earlier and finished it later than the one-year old flocks. The laying performance was poorer in the first year than any other subsequent years. Egg production and laying intensity, respectively, showed an increase of 22-50 and 3-13% in the second year and though they declined thereafter,

Table 2: Climatic data over the laying period of the goose flocks

		--- Laying week 2012 ---				---- Laying week 2013 ----			
Calendar week	DL (h:min)	T (°C)	RH (%)	One-year old flock	Elder flocks	T (°C)	RH (%)	One-year old flock	Elder flocks
52	8:28	3	84			-1.0	86		1
1	8:33	2.8	85			0	85		2
2	8:43	1.9	86			-2.9	86		3
3	8:56	-0.9	79			0.5	91		4
4	9:12	0.7	76		1	-1.8	86		5
5	9:30	-7.8	61		2	-2.3	87	1	6
6	9:51	-9.5	67		3	0.6	86	2	7
7	10:13	-4.3	75	1	4	2.2	79	3	8
8	10:36	1.6	81	2	5	2.4	86	4	9
9	10:59	3.9	66	3	6	4.0	74	5	10
10	11:23	0.5	58	4	7	8.1	79	6	11
11	11:47	6.6	61	5	8	1.1	81	7	12
12	12:11	11.6	52	6	9	2.6	66	8	13
13	12:35	11.1	44	7	10	2.0	87	9	14
14	12:59	11.8	57	8	11	5.6	79	10	15
15	13:23	8.8	61	9	12	10.2	75	11	16
16	13:46	11.7	71	10	13	14.4	58	12	17
17	14:08	15.3	65	11	14	19.2	58	13	18
18	14:30	20.9	56	12	15	20.0	67	14	19
19	14:50	17.4	67	13	16	18.7	76	15	20
20	15:08	12.8	69	14	17	17.1	76		
21	15:25	19.8	60	15	18	13.5	78		
22	15:38	16.8	64	16	19	15.4	79		
23	15:48	20.9	68	17	20	18.7	80		
24	15:55	19.4	79	18	21	22.0	69		

Source: Database of National Meteorological Service, Budapest, Hungary
DL: Average day length; T: Average daily air temperature; RH: Average daily relative humidity

Table 3: Egg production parameters of the goose flocks in 2012 and 2013

Flock age (year)	Initial no. of geese (head)	Sex ratio	Laying period (week)	Total egg/ goose (piece)	Defective egg (%)	Laying intensity (%)	Mortality rate (%)
Year 2012							
1	2298	3:1	18	35	6	28±17	15
2	1093	3:1	21	45	3	31±16*	8
4	874	3:1	21	42	4	29±13	19
5	738	3:1	21	43	5	29±15	16
2-5	902±179	3:1	21	43±1*	4±1	30±15	14±6*
Year 2013							
1	1335	3:1	15	28	12	27±15	28
2	1695	3:1	20	56	9	40±10*	8
3	1098	4:1	20	51	4	36±8	6
5	598	3:1	20	45	5	32±10	6
2-5	1130±549	3:1	20	51±6*	6±2	36±9	7±1*

Mean values indicated by asterisks in the same column differed significantly at level of $p<0.001$

Table 4: Correlation of laying intensity with day length in the goose flocks

		---------- One-year old flocks ----------			--------- Two to five year old flocks ---------		
Year	Phase of laying period	Week	r	p	Week	r	p
2012	Increase	1- 4	0.97	<0.001	1-5	0.985	<0.001
	Plateau	5-11	0.69	<0.05	6-15	-0.04	>0.10
	Increase and Plateau	1-11	0.85	<0.001	1-15	0.76	<0.001
	Decrease	12-18	-0.99	<0.001	16-21	-0.995	<0.001
2013	Increase	1- 7	0.98	<0.001	1-5	0.76	<0.05
	Plateau	8-12	0.22	>0.10	6-13	0.44	>0.10
	Increase and Plateau	1-12	0.90	<0.001	1-13	0.63	<0.05
	Decrease	13-15	-0.998	<0.001	14-20	-0.85	<0.001

were still higher in the fifth year than in the first. That is why the high producing goose flocks are kept even for six laying seasons and the much sought hatching eggs are sold instead of raising goslings-as it happened in this goose enterprise in 2009.

Light is of fundamental importance in the reproduction of poultry and the goose is a very photosensitive bird. The laying performance was primarily affected in the geese by the photoperiod, as a constant factor and to less extent by ambient temperature as shown by the

Table 5: Correlation of laying intensity with air temperature in the goose flocks

		---------- One-year old flocks ----------			--------- Two to five year old flocks ---------		
Year	Phase of laying period	Week	r	p	Week	r	p
2012	Increase	1- 4	0.40	>0.10	1-5	0.36	>0.10
	Plateau	5-11	0.16	>0.10	6-15	-0.14	>0.10
	Increase and Plateau	1-11	0.83	<0.001	1-15	0.70	<0.01
	Decrease	12-18	-0.16	>0.10	16-21	-0.60	<0.10
2013	Increase	1-7	0.69	<0.05	1-5	-0.13	>0.10
	Plateau	8-12	-0.02	>0.10	6-13	0.54	>0.10
	Increase and Plateau	1-12	0.61	<0.05	1-13	0.47	<0.10
	Decrease	13-15	0.29	>0.10	14-20	-0.68	<0.05

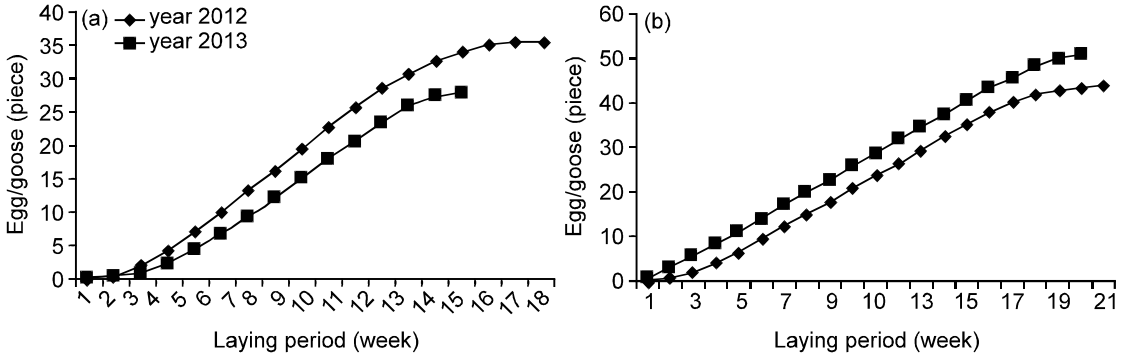

Fig. 1(a-b): Cumulative egg production in (a) one-year old and (b) two to five year old, goose flocks in 2012 and 2013

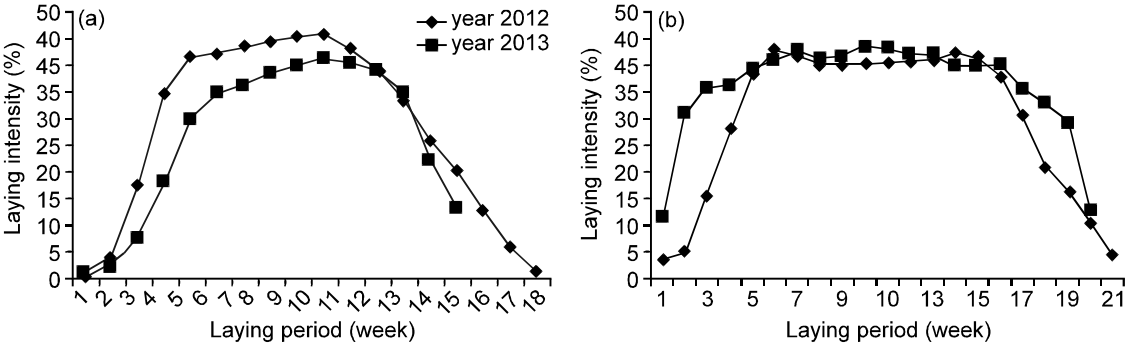

Fig. 2(a-b): Laying intensity in (a) one-year old and (b) two to five year old, goose flocks in 2012 and 2013

correlation of laying intensity with day length and air temperature. In hens laying performance was also affected by environmental temperature (Deaton *et al*., 1982). However there are very few data in the literature about the influence of relative humidity (Cavalchini *et al*., 1990).

ACKNOWLEDGEMENTS

The authors express their gratitude to the Hortobagy Goose Breeding Zrt. (Hungary) for permitting access to the egg production and mortality data of their breeding flocks and to the National Meteorology Service (Budapest, Hungary) for providing their climatologic database. The authors are also grateful to Attila Salamon (School of Biology and Environmental Science, University College Dublin) for constructive comments made on an earlier version of this manuscript.

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