 DOI: 10.35382/18594816.1.34.2019.188

GENE CONSERVATION PRACTICE AND PRODUCTION OF OLD HUNGARIAN GOOSE BREEDS

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Abstract – *Hungarian goose production and gene conservation practices have been a tradition in Hungary for several centuries. The old Hungarian geese can only be effectively maintained if the national programs can identify economic uses of the breed. This study aimed to examine the potential use of the Hungarian landrace goose (HL) either as a purebred or crossbred with the Hungarian Upgraded breed (HU). Crossbred offspring were produced by HL ganders and HU layers, as egg production of HL layers is very low. Reproduction traits (egg production, fertility and hatchability) of parent stocks, body weight gain, feed consumption and slaughter values (slaughter loss, breast and thigh weight and proportions) and of offspring were measured. The results showed that fertility in the crossbred geese was insignificant compared to the fertility of HL purebreds, while hatchability of crossbreds was higher than that of purebred HL or HU. HL offspring had significantly lower body weight and weight gain, and a higher feed conversion rate than HU. The proportion of valuable meat parts (breast and thigh) was the highest in HU while weight in slaughter loss was also the highest in HU. In terms of body weight, feed conversion rate and slaughter properties, crossbred offspring showed intermediate inheritance. HL is recommended for crossbreeding with HU breeds and their offspring should be reared under free-range keeping conditions.*

Keywords: Hungarian goose, gene conservation, goose production.

I. INTRODUCTION

Since the climate of Hungary is very favorable for goose production, its practice has become a tradition spanning several centuries [1]. Hungarian goose production is typically export-oriented, as the sector produces internationally recognized high-value products which are significant to the national economy [2]. Hungary is one of the largest producers of geese in Europe [3], where according to [4], Hungary is the second largest producer of goose and duck foie gras, and is the biggest producer of goose fatty liver production [5], [6]. The data from the Hungarian Poultry Product Council [7], [8] shows that the export revenue from goose products increased by 44% from 2014 to 2016. In 2016, the proportion of goose meat and liver from the countries whole poultry export was almost 20% demonstrates the economic importance of this sector. Previously, Hungarian breeder stocks were exported to Cuba in 1983, Russia (the former Soviet Union) in 1989, and China in 2005 [1], at present in Russia the Hungarian goose genotypes are still in high demand [9]. In Hungary, 22 genotypes- including meat and liver type breeds and hybrids - were recognized by the breeding authority in 2015, and out of the 22 genotypes, 15 genotypes (68%) were native Hungarian breeds [10]. This emphasizes the significance of domestic Hungarian goose breeding and goose gene conservation importance and traditions in Hungary. A white frizzled variety of the landrace Hungarian goose population has been maintained in its original form by the Debrecen University since 1975 [11]. A new gene

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Received date: 09^{th} May 2019; Revised date: 22^{nd} February 2019; Accepted date: 21^{st} August 2019

conservation programme for the Hungarian goose was started by the Institute for Small Animal Research (presently the Research Centre for Farm Animal Gene Conservation - HáGK), where growing populations of white, greyish and spotted color variants of frizzled goose collected from Transylvanian villages have been maintained [11]. Some new gene rescue programmes are being implemented to protect populations of geese such as the "Banat" Goose [12], "Garammenti" and "Lévai" Goose [13]. The origin of Hungarian geese date back to the Roman empire, when domestication of the greylag goose took place in the wet marshes in the Hungarian Great Plain of the Carpathian Basin. Over the centuries of farming practice, the breed became well adapted to the particular climate conditions of the country [14]–[16]. This study was conducted to examine the potential use of HL, either as purebred or cross-bred with HU.

II. BACKGROUND

A. Frizzled Hungarian goose

A unique variety of goose, called the frizzled Hungarian goose, used to commonly be found in a valley of the river Danube and around the coastline of the Black Sea. Frizzled feathers are caused by a mutant gene, an autosomal incomplete dominant single allele [14]–[16]. In homozygotes, the barbs are extremely curled so that no feather has a flat vane, heterozygotes are less extremely affected [16]. From the beginning of modern commercial goose breeding in Hungary, different color variants (white, greyish or spotted) were preferred not only for their excellent fatty liver quality, approved by all markets, but also for their meat quality which is present due to their foraging nature regardless of weather, and for their high-quality feather production [?], [14]–[16].

B. Hungarian Landrace and Hungarian Upgraded Geese

The Hungarian Upgraded (HU) goose breed was developed based on the Hungarian landrace (HL) goose – a type of utilization of HL. The breeding of white feathered stocks and selection of individual HL geese collected from the Great Hungarian Plain started in 1969 [17], in the Goose Breeding Research Station of the Gödöllő University of Agricultural Sciences (which later went on to become the Szent István University) in Babatpuszta. Different foreign breeds (mainly Embden) were used by small farms for increasing meat yield and reproduction traits (egg production) of Hungarian goose. According to [18], during the creation of founder stocks of the HU breed, the aim was to collect the most original Hungarian geese, despite their lower egg production. The HU was developed primarily by selection of reproductive traits within the HL breed. The results of this selective breeding programme was an average annual increase in egg production by 1 egg/year, an average annual improvements in fertility by 1%, an increased number of one-day-old goslings hatched per year, and increased meat production were observed in HU geese [17]. Main production characteristics of HL and HU geese are shown in Table 1.

Table 1: Production characteristics of Hungarian landrace (HL) and Hungarian Upgraded (HU) geese (adapted from [11])

Traits		HL	HU
Egg production (year) per layer		15	45-50
Egg fertility (%)		65	85-90
Mature body weight (kg)	Male	5.0-5.5	6.0-6.5
	Female	4.0-4.5	5.5-6.0

The old Hungarian geese populations can only be maintained if the national programs can identify economic use of the breeds [19].

III. MATERIALS AND METHODS

A. Experimental design

A comparative study of HL, HU and the crossbreeds were carried out at the Institute for Small Animal Research (predecessor of HáGK), in Gödöllő. Crossbred offspring were produced by crossing HL ganders and HU layers. As the egg production of HL layers is very low, the reciprocal crossing between HL layers and HU ganders would not be practical or economical. No artificial insemination was used for producing experimental goslings. Their sex was checked after hatching and a permanent sign of sex was used (a cut on the finger-web) throughout the study. The purebred and crossbred goslings were raised under the same conditions. The experimental design is shown in Table 2.

Table 2: Experimental design

Genotypes	Labels	Pens/ genotype	Males/ pen	Females/ pen
Hungarian landrace	HL	3	25	25
Hungarian upgraded	HU	3	25	25
♂Hungarian landrace × ♀Hungarian upgraded	♂HL × ♀HU	3	25	25

In the first 3 weeks, the geese were fed with a starter diet. The diet changed to grower in the 4th week after hatching and to goose life support feed in the 11th week. High-quality hay was also given to the youngsters as fibre consumption. Until 2 weeks of age, goslings were kept in caged conditions, from 2 to 8 weeks of age they could go to runner, and from 8 weeks of age, they were kept free-range with access to good quality pasture. Genotypes were kept separated, but the two sexes were kept together with a ratio of 1:1 (25 ♂ and 25 ♀ per pen). At 12 weeks of age, 8 males and 8 females which had the highest body weight were slaughtered from each genotype. Fertility and hatchability of eggs produced by parental HL and HU stock were investigated at the beginning of the experiment. Bodyweight, body gain weight and the feed conversion ratio (FCR) of offspring was checked every 2 weeks from birth. Slaughter weight loss, breast and thigh weight, and their proportions were measured at 12 weeks of age.

B. Data analysis

The data was processed with Microsoft Excel program, then analysed with ANOVA and T-test using SPSS software.

IV. RESULTS AND DISCUSSION

Fertility and hatchability results are shown in Table 3, which shows that the HU breed significantly outperformed the HL. The fertility of eggs that was produced by the crossbreeding between HL ganders and HU layers, was comparable to that of HL layers. Hatchability of eggs produced from the crossbreeding between HL ganders and HU layers was considerably higher than eggs produced from purebred HU geese.

Table 3: Fertility and hatchability of eggs produced by Hungarian landrace (HL), Hungarian Upgraded (HU) and the cross between Hungarian landrace ganders and Hungarian Upgraded layers (♂HL × ♀HU)

Genotype	Fertility %	Hatchability	
		% of incubated eggs	% of fertile eggs
HL	65.0	45.2	68.4
♂HL × ♀HU	67.8	61.2	91.1
HU	84.9	73.8	86.8

Comparing the two purebred breeds, it can be stated that the HL breed had significantly lower body weight and weight gain than HU. The weight of the crossbred offspring was close to the average of the offspring of the two breeds throughout the 22 week period. The difference in body weight between the two sexes of HL was higher than in the HU. Apparent sexual dimorphism was also reported in the weight of HU [20]. The sexual dimorphism displayed by the body weight of crossbreds was less than in HL, or even HU. Table 5 shows that there was no difference in FCR during the first 4 weeks. From the 4th week, the HU breed displayed the best results, and FCR of the HU and HL crossbreds was in-between. Better FCR was found in HU even though feed consumption of HU significantly exceeded HL. Bodyweight data is summarized in Table 4.

Besides live weight, the weight of valuable meat parts (breast and thigh) was the highest in the HU breed. However, the slaughter loss was also the highest in this breed, and the lowest in HL, although the difference between the genotypes was not substantial. Previously, Bleyer [21] had chosen the Szentes Nagyfehér (Golden Goose W) and Lippitsch genotypes which were specifically selected for meat production at 8 weeks of age, however, comparably the slaughter loss of those genotypes was essentially equal to the genotypes HL, HU and HL and the HU crossbreed. The proportion of valuable meat parts (breast and thigh) were the highest in the HU genotype. It significantly exceeded the results reported by Bódi [22]. Slaughter results are given in Table 6.

V. CONCLUSION

In terms of weight and FCR, the advantage of HU is apparent, but the HL genotype resulted in better slaughter weight results, this demonstrates the economical usability of the breed. Body weight, FCR and slaughter properties expressed by crossbred offspring showed intermediate inheritance. In crossbreeds however, due to low egg production of the landrace Hungarian breed, HL can produce economically only as a male partner.

ACKNOWLEDGMENT

The research was carried out in the frame of the GAK öko_term (ALAP1-00123/2004) project, subsidized by National Research, Development and Innovation Fund (NKFIA).

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Table 4: Average body weight of Hungarian landrace (HL) and Hungarian Upgraded (HU) breeds during the 22-week rearing period

Genotype	Gender	Average body weight, g						
		1 day old	Age, weeks					
			4	8	12	16	20	22
HL	♂	81	1272	2884	3346	3770	4088	4174
	♀	82	1188	2460	2846	3220	3446	3509
♂HL × ♀HU	♂	86	1327	2910	3816	4004	4433	4735
	♀	87	1462	2776	3430	3602	3869	4135
HU	♂	91	1498	3298	4393	4848	5288	5450
	♀	88	1387	3104	3938	4271	4658	4804

Table 5: Feed conversion ratio (FCR) in kg feed/kg body weight gain of experimental Hungarian landrace (HL), Hungarian Upgraded (HU) and their crossbreeds (♂HL × ♀HU) in 4 different periods of rearing

Period, weeks of age	HL	♂HL × ♀HU	HU
0-4	2.1	2.0	2.1
4-10	3.8	4.4	4.5
10-22	18.9	23.7	24.0
0-22	5.5	6.0	6.3

Table 6: Slaughter results of male Hungarian landraces (HL), Hungarian Upgraded (HU) and their crossbreeds (♂HL × ♀HU) at 12 weeks of age

Genotype	HL	♂HL × ♀HU	HU
Live weight (g)	3867	4720	5087
Slaughter weight(g)	2912	3539	3806
Live weight/slaughter weight (%)	75.3	75	74.8
Breast weight (g)	922	1243	1370
Thigh weight, (g)	729	786	870
Breast and thigh weight/ slaughter weight %	56.7	57.3	58.9

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