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SELECTION AND REPRODUCTIVE CHARACTERS OF THE OBROSHYN GRAY BREED GROUP OF GEESE

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Abstract

It is known that the success of breeding poultry depends on the level of selection and breeding work, and the use of feeding and growing technologies. The method of research work was to investigate the reproductive qualities of the gray breed group of geese of Obroshinsky selection and to analyze the productivity indicators in different periods of cultivation. The review presents the state of the poultry industry development at the beginning before military operations and during 2022 against the background of the war, as well as the prospects for innovative development of the waterfowl industry in the territory of Western Ukraine and the possibility Obroshinsky gray geese in crossings to obtain local young goslings. The intensity of growth, the development of the young, and its preservation during the rearing period were studied, and the reproductive qualities of Obroshin gray geese were analyzed. As a result of the selection and breeding work, the geese of the II research group (OS-5 ♂ x OS-3 ♀) outperformed their peers, respectively: in insufficiency by 3.4%, fertilization by 3.9%, and hatching of goslings by 4, 1%. The muscle mass of the males of the II experimental group was 1698, which was 8.8% more likely ($p < 0.01$) than the males of the I group. Females of the II group, whose muscle mass was 1560 g with probability ($p < 0.001$), prevailed over their peers (1390 g) by 8.6%.

Key words*: breeding, geese, live weight, poultry, productivity.*

INTRODUCTION

Poultry farming is one of the important branches of agriculture, providing the population with high-quality dietary food products: meat, eggs, and down and feathers.

Agricultural poultry is characterized by early maturity, intensive growth, high reproductive capacity, productivity, and viability.

All this in a complex combination of knowledge in the field:

- methods and directions of genetic improvement of birds;
- physiological basis of reproduction and breeding of birds;
- biotechnology of poultry farming;
- conditions for keeping breeding and commodity herds;
- environmental conditions that ensure the well-being of birds and low feed costs per unit help the high profitability of the industry (Jankowskie, 2012; Polehenka, 2019; Yatsiv, 2021).

Poultry farming is a rapidly recovering industry. During the years of independence, despite the problems, Ukraine has built up the potential to be ready for post-war recovery and development (Avercheva, 2022).

In recent years, such a direction of poultry farming as goose farming has been of particular interest (Ashton, 2012).

Effective management of the innovative development of the goose farming industry with the application of scientific achievements will open up new opportunities to improve the quality of not only delicacy products but also products with therapeutic and preventive properties (Cheng et al., 2019).

The specific weight of poultry in the Carpathian region is 11.0% of all poultry in Ukraine. As of February 1, 2022, there were up to 11,640 thousand heads in all categories of farms in the

Lviv region. Since most waterfowl are concentrated in private peasant farms, most goose meat is used for family consumption, and its surpluses are sold mainly through intermediaries in local markets (State Statistics Service of Ukraine, Statistical Yearbook of Ukraine, 2022).

The number of poultry in all categories of Ukrainian farms amounted to 202.2 million heads, which is 0.7% more compared to the corresponding period last year, of which 113.5 million heads are in agricultural enterprises (by 2.9% more), in households – 88.7 million heads (by 2.0% less). According to the data of the Department of Agrarian Development of the Ministry of Agrarian Policy, the state of the industry as of October 1, 2022, in the peaceful territory of Ukraine is 164,850.9 thousand heads (81.6%) and territories where hostilities took place and are taking place – 37,078.3 thousand people (18.4%) (Statystychnyy shchorichnyk Ukrayiny, 2023).

In the poultry industry of Ukraine, a meat direction is being formed from the use of birds with genetically determined characteristics: intensive growth at an early age, fattening ability for fatty liver, increased yield of feathers, and down during early life plucking (Tereshchenko et al., 2011; Zhukorsky et al., 2014).

In Ukraine, geese are bred in specialized enterprises to obtain meat, breeding eggs and day-old young, and in homesteads – for meat, fat, feathers, and down (Lyubenko & Sabbot, 2019).

In terms of growth rate, and the ability to digest a significant amount of green and juicy feed with a high fiber content, high vitality, and other economically useful characteristics, geese have a number of advantages compared to chickens, turkeys, and ducks. Only the ability of geese to digest vegetable fiber in high quality and large quantities puts them in the first place among other types of poultry. Breeding geese for meat is a very profitable business. Geese grow quickly, are undemanding to feeding and keeping conditions, and are a source of tasty meat, fatty liver, feathers, and down. (Lyubenko et al., 2021).

Goose meat is dietary and has specific culinary properties. Geese gives the highest yield of edible parts (54%) compared to other poultry: chickens, turkeys, and ducks (48-52%) and are also characterized by high energy nutrition (1550 kJ in 100 g of meat) versus 840-1533 kJ, respectively. Quite valuable products are goose feathers and down, which is 6-8 % of the live weight of the bird (Bashchenko et al., 2016; Fedorko et al., 2016).

Geese are the most economically important poultry species in the world. However, the low reproductive capacity of geese significantly limits their industrial scale. Until now, most research on the reproductive performance of geese has focused on females, although a number of scientists (Ding et al., 2014; Brillard, 2003) believe that the male is also crucial for the reproduction of the flock.

Because the heritability of phenotypes related to male reproduction (sperm quality) was significantly higher than that of females among domestic animals. It is the results of such scientists as Berry et al. (2014), indicate the importance of studying the reproductive capacity of geese.

Improvement of breeding qualities of geese, lines, and crosses is determined by the level of selection work with them. The most important property of the line is its ability, when crossed with another line, to give offspring with the phenomenon of heterosis according to one or more indicators of productivity (Paskevich et al., 2021).

However, despite the accumulated scientific and practical experience, the questions highlighted in our research work, which are aimed at studying the compatibility of lines and families and identifying new features in the productive qualities of males, which are used as continuations of lines with high reproductive rates, remain relevant.

MATERIALS AND METHODS

The research was conducted on geese of the Obroshin breed with gray plumage. For experimental studies, two groups of geese (males and females) of 50 each were formed in each:

– group I males of line OS-3, mated with females of line OS-5;

– II group - males of line OS-5 (obtained by infusion of blood of geese of the large gray breed), mated with females of line OS-3 of the Obroshin gray breed group of geese.

Reproductive ability was studied based on the results of egg incubation and the evaluation of goose productivity. A daily calculation of egg production was carried out with the deduction of egg weight, followed by selection based on this indicator for incubation.

The resulting hatching eggs from group mating after sorting and selection every 10 days were incubated from each group separately.

The hatching quality of eggs was determined by their fertilization and hatching of goslings.

The physical parameters of the eggs were evaluated by their weight, length and width, shape index, shell strength, and thickness according to generally accepted methods.

Egg mass was determined by weighing on an SF-400 scale with an accuracy of 0.01 g. The egg shape index was calculated as the ratio of diameters along the long and short axes (measurements will be made with a caliper with an accuracy of 0.1 cm). The thickness of the shell with the subshell was measured with a micrometer at the blunt and sharp ends and in the equatorial part of the egg (the average value was determined to the nearest 0.01 mm). The strength of the shell - by measuring the elastic deformation using the PUD-2 device, designed by P. P. Tsarenko.

Goslings were selected for their appearance at day-old age. In the process of rearing, goslings with a live weight lower than the average value for the herd at the age of 9 and 12 weeks were culled. At the same time, geese with well-developed meat forms were selected based on external signs, in the absence of external defects, and the measurements of body parts associated with meat forms were determined. Growth and development of young animals were monitored up to 12 weeks of age. Two groups of day-old goslings (OS-3 and OS-5) were formed for research. The live weight of geese of both sexes was determined by weighing a day, 4-, 9-, and 12-week-old age on SF-400 scales with an accuracy of 0.01 g.

The exterior of young geese in the above-mentioned age periods should be studied by measurements of breast girth, body length, keel, leg, and foot. In the process of cultivation, the preservation of young animals up to 9 weeks of age was taken into account.

In order to study the meat qualities of poultry, a controlled slaughter of geese was carried out at the age of 9 weeks, 4 heads from each group, and the pre-slaughter weight, chilled carcass weight, skin with subcutaneous fat, internal fat, muscles, and bones were examined.

To evaluate the probability of the obtained results – arithmetic mean values (M), arithmetic mean error (± m), and the probability of differences between the studied arithmetic mean values (P) were statistically processed using the computer mathematical and statistical program "Microsoft Excel". The difference between mean values was considered statistically significant at $P<0.05$ (*), $P<0.01$ (**), $P<0.001$ (***) (Petrovska et al., 2022).

RESULTS AND DISCUSSIONS

After a preliminary evaluation of the best females with their highest economically useful traits (egg production, egg weight, live weight, viability, strength of constitution and exterior) and males with a strong constitution, optimal weight, and characteristics for the breed group exterior and high hatching qualities two groups of geese were formed in the ratio of males and females 1:4 (50 heads in each group).

Experimental geese were kept separately for the period of mating and egg-laying (January-May) with adequate feeding and maintenance regime.

One of the important indicators in the assessment of productive and breeding qualities is egg mass, which is related to sexual maturity, age, laying capacity, hatchability of eggs and live weight at day age.

Reproductive capacity was determined based on egg incubation results and goose performance evaluation.

The average live weight of birds at the beginning of egg laying was (OS-5♀ × OS-3 ♂) I group geese – 6.10 kg, geese – 7.20 kg, and (OS-3♀ × OS-5♂) II group: geese – 6.25 kg, geese – 7.35 kg.

The average egg-laying rate of geese of the first experimental group was 38.6 pcs. eggs per head, the average egg weight is 160.0 g, in the II group – 39.9 pcs. eggs and was higher by 3.4%, however, the average weight of eggs in the II group was 158.0 g (Table 1).

Along with weighing, every day, during the period of intensive egg-laying, the measurements of the eggs (length and width) were taken and the index of their shape was determined.

Table 1. Laying and incubation qualities of eggs (M ± m)

Indicator	Group of geese	
	I	II
Duration of egg laying, days	95 ± 4.90	103 ± 5.30
Average egg production, pcs. eggs	38.6 ± 1.40	39.9 ± 1.70
The average weight of the egg, g	160.0 ± 2.50	158.0 ± 2.60
Egg length, mm	85.6 ± 0.20	84.8 ± 0.17
Egg width, mm	56.2 ± 0.17	55.6 ± 0.12
Form index, %	65.6	65.6
The strength of the shell, kg / mm^2	2.15 ± 0.6	2.17 ± 0.4
Shell thickness, mm	0.53 ± 0.005	0.55 ± 0.007

These parameters in the 1st group were: egg length – 85.6 mm, width – 55.6 mm, shape index 65.6%, respectively – 84.8 mm in the 2nd group; 55.6 mm; 65.6%.

According to these indicators, no probable difference was established, however, the duration of egg-laying in geese of the II group lasted longer by 8 days.

The study of the hatching qualities of the eggs shows that the highest fertilization rate, as well as the hatching of goslings, was in the II research group and amounted to 84.1%, which is 3.9% more than in the I group (Figure 1).

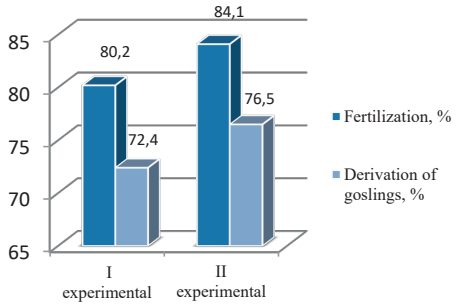

Figure 1. The results of incubation of goose eggs, %

The hatching of goslings was also higher in the II group (76.5%) by 4.1%.

Studying the growth and development of geese at different stages of ontogenesis is one of the most informative indicators of the breeding and productive qualities of the bird.

Indicators of the live weight of geese of experimental groups in different age periods are given in Table 2.

Regarding the characteristics of live weight and growth rate, it should be noted the intensive increase in live weight in the first month of life of young animals.

Table 2. Dynamics of live weight of geese, kg (M ± m, n = 30)

Group	Age of geese			
	1 day	4 weeks	9 weeks	12 weeks
	Males			
I	0.102 ± 0.017	1.74 ± 0.27	4.30 ± 0.48	5.52 ± 0.29
II	0.103 ± 0.026	1.91 ± 0.30	4.49 ± 0.32	5.87 ± 0.21
Females				
I	0.099 ± 0.014	1.72 ± 0.21	3.84 ± 0.29	4.69 ± 0.19
II	0.101 ± 0.022	1.80 ± 0.28	3.95 ± 0.32	4.85 ± 0.18

At the age of one day, the goslings of both groups had relatively the same live weight: Group I males - 102.0 g, females – 99.0 g; Group II males - 103.0 g, females - 101.0 g. At 4 weeks of age, a difference in live weight was determined - males of the II group exceeded their analogs by 9.8%, and females by 4.7%.

At 9 weeks of age, the same trend was maintained - males of the II group outnumbered the males of the I group by 4.4%, and females of the II group outnumbered the females of the I group by 2.9% (Table 4). The same regularity was observed at 12 weeks of age.

Increasing the preservation of young birds at an early age and ensuring the high intensity of their growth at all rearing stages is one of the most urgent problems of modern poultry farming. The preservation of young geese up to 9 weeks of age is an important indicator that affects the economy of the industry. When a bird has high immunity, then it is less prone to diseases during the rearing period (Ivko et al., 2010). The presservation of the population of young Obroshin gray geese up to 9 weeks of age turned out to be better in the II research group (Figure 2).

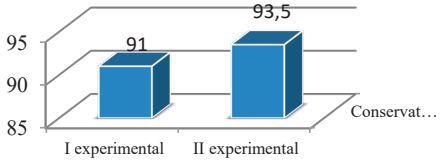

Figure 2. Survival rates of young geese up to 9 weeks of age, %

For a more complete characterization of the processes of growth and development of geese over the age periods, measurements of their body parts were carried out.

In one-day-old males of the 1st group, the chest girth was 12.1 cm, in females – 10.4 cm; body length 12.1 and 11.4 cm, respectively; keel length – 2.5 and 2.4 cm; leg length – 5.0 and 4.8 cm; the length of the metatarsus is 3.9 cm in males and 4.2 cm in females. In the same period, males of the II group had a chest girth of –12.6 cm, females -10.8 cm; body length of 12.2 and 11.8 cm, respectively; keel length – 2.6 and 2.8 cm; shin length – 5.5 and 4.9 cm; metatarsal length – 3.7 and 4.3 cm. No significant difference between groups was noted (Table 3).

Table 3. Measurements of the main articles of the body, cm (M ± m, n = 30)

Group	The sex of the	Chest girth	Length			
			body	of the keel	shin	metatarsal bones
1st day						
I	Males	12.1 ± 0.13	12.1 ± 0.15	2.5 ± 0.18	5.0 ± 0.24	3.9 ± 0.08
	Females	10.4 ± 0.17	11.4 ± 0.14	2.4 ± 0.14	4.8 ± 0.10	4.2 ± 0.11
II	Males	12.6 ± 0.32	12.2 ± 0.17	2.6 ± 0.11	5.5 ± 0.11	3.7 ± 0.21
	Females	10.8 ± 0.43	11.8 ± 0.11	2.8 ± 0.15	4.9 ± 0.17	4.3 ± 0.16
4 weeks						
I	Males	28.4 ± 0.15	28.4 ± 0.16	10.0 ± 0.17	13.8 ± 0.13	8.9 ± 0.09
	Females	27.1 ± 0.19	27.3 ± 0.11	8.9 ± 0.10	11.4 ± 0.19	8.3 ± 0.14
II	Males	28.9 ± 0.12	29.3 ± 0.12***	10.5 ± 0.16*	14.2 ± 0.37	9.4 ± 0.08***
	Females	27.8 ± 0.21	27.3 ± 0.19	9.1 ± 0.19	12.2 ± 0.22	8.7 ± 0.12*
9 weeks						
I	Males	38.6 ± 0.25	32.5 ± 0.16	12.3 ± 0.17	16.8 ± 0.13	10.2 ± 0.15
	Females	36.8 ± 0.18	30.9 ± 0.17	12.0 ± 0.10	14.1 ± 0.19	8.9 ± 0.18
II	Males	39.5 ± 0.18	33.1 ± 0.17	12.9 ± 0.13	19.0 ± 0.37***	10.9 ± 0.18***
	Females	37.5 ± 0.21	31.5 ± 0.15	12.6 ± 0.14	15.0 ± 0.22	9.5 ± 0.12*
12 weeks						
I	Males	51.1 ± 0.15	41.7 ± 0.18	18.0 ± 0.20	17.2 ± 0.16	10.1 ± 0.09
	Females	50.2 ± 0.17	41.1 ± 0.21	17.5 ± 0.18	16.2 ± 0.21	9.1 ± 0.14
II	Males	53.2 ± 0.16	42.6 ± 0.15	18.5 ± 0.19	18.8 ± 0.25***	10.9 ± 0.22***
	Females	51.9 ± 0.19	41.8 ± 0.16	17.9 ± 0.20	17.1 ± 0.19	9.7 ± 0.20*

Note: *P≤0.05; ** P≤0.01; ***P≤0.001

At the age of 4 weeks, the chest girth in males of the I group was 28.4 cm, in females - 27.1 cm; body length was 28.4 and 27.3 cm, respectively; keel length - was 10.0 and 8.9 cm; shin length was 13.8 and 11.4 cm; the length of the metatarsus is 8.9 and 8.3 cm. Males of the II group at the age of 4 weeks exceeded the analogs of the I group in terms of chest girth by 1.6%, body length by 3.2%, keel by 5.0%, lower legs - by 2.9%, and metatarsals - by 5.6%. The advantage of females according to these indicators was 2.6%, and 0.7%, respectively; 2.2; 7.0, and 4.8%.

At 9 and 12 weeks of age, the males of the II group exceeded their peers from the I group in terms of chest girth by 2.3 and 4.1%. The males of the II group exceeded the males of the I group by 1.8 and 2.2% in body length, and by 4.9 and 2.8% in keel length, respectively. The same trend was observed in the measurements of the lower leg and metatarsal, so the males of the II group exceeded the males of the I group by 13.1 and 9.3% according to the first indicator; according to the second indicator, the males of the II group probably ($p<0.01$) prevailed over the males of the I group by 6.9 and 7.9%.And so, respectively, at 9 and 12 weeks of age females of the II group exceeded their peers from the I group by 1.9 and 3.4% in breast girth, and by 1.9 and 1.7% in body length. In terms of keel length, females of the II group exceeded their peers from the I group by 5.0 and 2.3%. Measurements of shins and metatarsal in females of the II group were also the largest and exceeded the females of the I group by 6.4 and 5.6% according to the first indicator, and according to the second indicator, the females of the II group exceeded the females of the I group by 6.7 and 2.1%.

The study of meat qualities is important for the performance characteristics of geese. The main muscle growth in geese ends at the age of 9 weeks. After reaching this age, there is an accumulation of fat in the carcass of the bird and

an increase in the skin with subcutaneous fat. To study the meat qualities, we slaughtered a bird at the age of 9 weeks and determined the morphological composition of the carcass. According to the absolute indicators of pre-slaughter live weight, carcasses of males of the II group (4690 g) exceeded their peers of the I group by 2.4%, and females of the II group (4184 g) exceeded their peers by this indicator by 4.5%.

Analyzing the data, it should be noted that the weight of the cooled carcass with subcutaneous fat, internal fat, and muscle is higher in males of the II group.

The weight of the cooled carcass of males of the II group was 3125 g, which is 6.0% more than that of the males of the I group, and the females of the II group (2682 g) exceeded their peers by this indicator by 6.9% (Table 4).

Table 4. Results of the slaughter of geese of experimental groups at the age of 9 weeks (M ± m, n = 4)

Indicator		Group, the sex of the			
		I		II	
		males	females	males	females
Pre-slaughter live weight, g	M ± m	4580 ± 27	4002 ± 41	4690 ± 26*	4184 ± 34**
Mass of chilled carcass, g	M ± m	2948 ± 45	2508 ± 27	3125 ± 34*	2682± 33**
Skin with subcutaneous fat, g	M ± m	700 ± 31	620 ± 38	690 ± 31	630 ± 17
	%	23.74	24.72	22.08	23.49
Internal fat, g	M ± m	105 ± 5	71 ± 8	100 ± 4	68 ± 6
	%	3.56	2.40	3.20	2.54
Muscles, g	M ± m	1560 ± 39	1280 ± 25	1698 ± 31*	1390 ± 21**
	%	52.92	51.04	54.36	51.83
Bones, g	M ± m	583 ± 29	537 ± 24	637 ± 29	594 ± 17
	%	19.78	21.94	20.36	22.14

The mass of skin with subcutaneous fat in males of group I was higher and amounted to 700 g, which is 1.4% more than that of males of group II, and females according to this indicator had higher results in group II (630 g).

The mass of internal fat in males and females of both groups was almost at the same level (males – 105 and 100 g, females 68 and 71 g).

The muscle mass of the males of the II group was 1698 g, which was 8.8% higher than the males of the I group (1560 g) and by the degree of probability ($p < 0.05$) and with the probability ($p < 0.01$) the females of the II group (1390 g) outnumbered their peers by this indicator – by 8.6%.

Thus, based on the above data, it is possible to note the better meat productivity of geese of the II group. Analyzing the data on the development of pectoral and femoral muscles, it should be noted that the males of the II experimental group were characterized by the best meat productivity at the age of 9 weeks, in which the pectoral muscle mass of males was 470 g, which was 5.9% higher than that of males And groups and females had almost the same results for this indicator (418 and 422 g) (Table 5).

Table 5 Development of pectoral and thigh muscles of geese at 9 weeks, g

Group	The sex of the	Indicator
		Pectoral muscles
I	males	444±3.5
	females	418±8.0
II	males	470±4.2
	females	422±4.8
		Femoral muscles
I	males	455±4.4
	females	400±4.8
II	males	472±6.4
	females	419±7.1

The mass of femoral muscles was 472 g in males and 419 g in females, which was 3.7 and 4.8% higher than in the first group.

CONCLUSIONS

It was established that the geese of the II experimental group (OS-5 ♂ x OS-3 ♀) were characterized by the best indicators of laying and incubation qualities, the productivity of which was 39.9 pcs. eggs, which was 3.4% higher than that of peers, and the duration of egg-laying was 8 days longer.

Their fertilization rate was 3.9%, and the hatching of goslings was 4.1% higher than in the 1st group (OS-3 ♂ x OS-5 ♀).

The indicators of live weight of males of the II group at the age of 4 weeks were also higher by 9.1%, and of females by 5.8%, compared to peers of the I group.

At the age of 9 weeks, males of the II group outnumbered their counterparts by 4.4%, and females outnumbered the females of the I group by 2.9%. The same regularity was observed at 12 weeks of age.

Based on the assessment of the measurements of the main parts of the body, it was established that the males of the cross OS-5 ♂ x OS-3 ♀ (II group) exceeded their peers from the I group in terms of the length of the trunk, keel, and metatarsals, while females had an advantage only in the measurement of the length of the metatarsal ($P < 0.05 - 0.001$).

It was established that the best slaughter results at the age of 9 weeks were characterized by the geese of the II experimental group, in which the muscle mass was 1698 g, which by 8.8% and by the degree of probability ($p<0.05$) exceeded that of the males of the I group, whose mass was 1560 g, and with probability ($p<0.01$), the females of the II group (1390 g) exceeded their peers by this indicator – by 8.6%.

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