American Journal of Animal and Veterinary Sciences

Original Research Paper

The Influence of Geese Age on Their Productive and Reproductive Qualities

[1]Danis Khaziev, [1]Rinat Gadiev, [1]Albert Farrakhov, [2]Alfiya Gayfullina, [3]Marina Kazanina and [2]Alexandra Andreeva

[1]Department of Beekeeping, Private Zootechny and Breeding of Animals, Federal State Budgetary Educational Establishment of Higher Education "Bashkir State Agrarian University", Russian
[2]Department of Physiology, Biochemistry and Animal Feeding, Federal State Budgetary Educational Establishment of Higher Education "Bashkir State Agrarian University", Russian
[3]Department of Morphology, Pathology, Pharmacy and Non-Communicable Diseases, Federal State Budgetary Educational Establishment of Higher Education "Bashkir State Agrarian University", Russian

Article history
Received: 25-08-2021
Revised: 29-11-2021
Accepted: 20-12-2021

Corresponding Author:
Danis Khaziev
Department of Beekeeping, Private Zootechny and Breeding of Animals, Federal State Budgetary Educational Establishment of Higher Education "Bashkir State Agrarian University", Ufa, Russian Federation
Email: khazievdan@rambler.ru

Abstract: This study aims to determine the optimal age for using breeder geese for hatching eggs. Four parties of experimental groups of geese of a large grey breed were formed to conduct a scientific and economic experiment. There were three groups of geese in each party, with the female geese aged 1, 2, 3 years and the male geese of 1,2,3,4 year of use, respectively. During the research period, geese of the second year of use showed the best survival rate indicators amounting to 95.8%. The live weight of geese increased with an increase in their age. There was a decrease in the live weight of geese during the productive period. The oldest geese had the highest decrease values. Geese of the third year of use produced 42.5 eggs, 2.5-10.3 eggs more than in other age groups. The egg weight of geese of the third year of use was 179.62 g, which is 6.5-13.2% higher than other age groups. Comprehensive analysis showed that female geese' productive and reproductive qualities increase with the increase in their age. Geese of the parent herd of a large grey breed of the third year of use had the best production indicators.

Keywords: Age, Egg Production, Geese, Live Weight

Introduction

The poultry age is a significant factor affecting the manifestation of poultry productive and reproductive qualities. Domestic and foreign scientists studied significant factor direction (Andreeva *et al*. 2018; Gabitov *et al*. 2018a, b; Tagirov *et al*., 2018). Sukhanova *et al*. (2017) studied the main parameters that significantly affect geese egg productivity. Using analysis of variance, the authors revealed that the range of influence of age indicators was in an average degree and ranged from 25.14%. The influence of the season and breed on geese's productive and reproductive qualities ranged from 0.10 to 71.01%.

Polish scientists like Biesiada-Drzazga *et al*. (2016) studied changes in the morphological characteristics of eggs depending on the geese age. The author revealed that one-year-old geese laid eggs of the lowest average weight. During the second egg-laying season, geese laid eggs of the highest average weight. The oldest geese had the highest values of the egg shape index. The same authors found that the egg-laying period decreases with geese age from 138 days in the second year to 117 days in the fourth year. Besides, the number of eggs laid during the season decreased from 81 to 71. Similar experiments were conducted on laying hens by Yalcin *et al*. (2020). They studied the influence of the slaughter age of laying hens on the chemical composition of poultry meat and revealed the increase in the slaughter age. The colour of the meat changed, getting darker, more reddish and yellow than young chickens' meat. In addition, the same authors found that dry matter, crude protein, fat, total ash and collagen content also increase with the slaughter age increase. The authors concluded that an increase in the slaughter age of laying hens leads to a change in the carcass and meat properties. Salamon (2020) found that female-geese fertility is usually lower in the first year but reaches its peak in the second or third year and gradually decreases. Liu *et al*. (2021) studied the relationship between the geese age and egg weight and found that the weight of an egg changes with goose age. The largest yolk is produced after the second egg-laying season when the

Science Publications

egg-laying productivity tends to decrease. Belkot and Pyz-Lukasik (2011) studied the influence of the geese age on the quality of basting fat and its chemical composition. The research revealed that age affects chemical composition, fatty acid profiles and the goose fat smell. Geese age exerts a strong influence over the chemical composition, mainly basting fat, which in young poultry contains more protein, water, ash and less fat. The fat of old geese has a higher nutritional value and this fat contains less saturated fats and more mono- and polyunsaturated fats than the fat of young poultry.

Analysis of literature sources devoted to the influence of the birds' age on the manifestation of their productive properties and the meat quality revealed the lack of clear recommendations on the duration of their use. There is also no information on the dependence of the duration of use on the geese breed.

Materials and Methods

Geese of the parent herd of a large grey breed were used in this study. The experiments were held at LLC "Bashkir Poultry" of the Blagovarsky district of the Republic of Bashkortostan. Geese of different ages were divided into 12 experimental groups according to the principle of analogues. Each group had 48 geese so that there was one male goose per 3 female geese. Experimental groups 1, 2 and 3 (party 1) consisted of male geese of the first year of use and female geese of the first, second and third years of use. Experimental groups 4, 5 and 6 (party 2) consisted of male geese of the second year of use and female geese of the first, second and third year of use. In experimental groups 7, 8 and 9 (party 3), there were male geese of the 3rd year of use and female geese of the 1st, 2nd and 3rd year of use.

Experimental groups 10, 11 and 12 (party 4) consisted of geese of the 4th year of use and female geese of the 1st, 2nd and 3rd years of use. According to the recommendations for raising and keeping poultry, the conditions in all groups were the same. Geese of all groups were fed the same way. The experiments lasted 150 days.

Statistical Analysis

The research results were processed using the Microsoft Excel program and analysis of variance. The Student's t-criterion was used to estimate statistical significance at three levels of significance: *p<0.05 and **p<0.01.

Results

In the research, high values of the survival rate of geese of different age groups during their productive period were established. Differences between geese from different groups were revealed depending on their age. According to the studies, geese of experimental groups 4, 5 and 6 showed the highest survival indicators amounting to 95.8,

2.0-6.2% higher than the same-aged geese of other analyzed groups. In these groups, male geese of the second year of use mated with female geese of the 1st, 2nd and 3rd years of use as presented in Fig. 1.

Livestock survival is one of the determinants of the effective production of agricultural products and it directly depends on animals' strong immunity. Farm animals and poultry need favourable conditions and a balanced, nutritious diet to achieve their genetic potential, thus strengthening immunity.

Another critical indicator of poultry productivity is live weight. This indicator depends on the breed, age, gender, feeding and maintenance conditions and poultry physiological state.

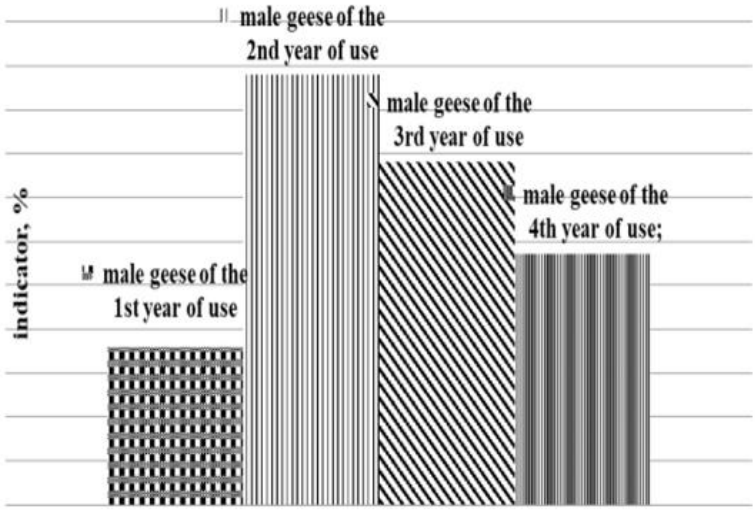

Fig. 1: Survival rate (%) of the geese of the parent flock during the productive period

Studies have shown that the live weight of adult male and female geese varies in different groups, as shown in Table 1.

The productivity of males and females gradually decreased with the duration of the breeding season. It slightly increased in June in the first and second groups.

According to Table 1, the live weight of females decreased from 4.02 to 7.01% over the entire egg-laying cycle. During the egg-laying period, there was a monthly decrease in the live weight of females. The live weight of males during the productive period also decreased, amounting to about 6%.

Table 1 shows no live weight deviations from the breed standard of geese of all groups during the productive period.

The live weight of males and females decreased from February to the end of the productive period. There was also a significant decrease in geese live weight at the peak of the egg-laying period, as presented in Table 2.

At the beginning of the experiment, the live weight of geese was 3.06-3.89% higher than in the middle. At the end of the analyzed period, it increased but did not reach its level at the beginning of the productive cycle, as found in Table 3.

During the production cycle, it is necessary to monitor the level of the live poultry weight and its compliance with established standards.

Live weight depends on many factors: Heredity, sexual differences, age and maintenance and feeding conditions, which are especially important. Low live weight affects the poultry reproduction indicators. High live weight leads to its decrease due to obesity. Male geese become passive, which negatively affects the fertilization of eggs.

For the entire research period, the geese of experimental group 9 had the highest live weight, which averaged 5,056.3 g and was 387.4 g more than in group 7. The live weight of female geese of experimental groups 7 and 9 was analyzed.

The analysis showed that the indicators of experimental group 9 were 9.1, 7.9 and 8.8% higher than those of experimental group 7.

Analysis of the live weight of male geese of the third year of use and the duration of the productive period revealed a decrease in their live weight.

The live weight decrease is due to the outside temperature increase and the reproductive qualities of males, as presented in Table 4.

This process was regular for females and males when using male geese of the 4th year of use. Analysis of the live weight dynamics showed that females live weight decreased more intensively due to an increase in egg productivity. For maintaining the standard live weight during the productive period, poultry should receive more nutritious mixed feed. During the productive period, changes in the feeding regime and a decrease in the nutritional value of feeding are impossible. The diet requires detailing, taking into account the poultry needs and the level of its productivity. The main factor determining the number of goslings and goose meat amount is egg production. Therefore, this is one of the main breeding characteristics and a strong indicator of egg productivity. Creating optimal conditions to ensure high poultry productivity is the main task of industrial poultry farming. Tables 5-8 show the egg production and egg mass of geese of the parent flock.

According to Table 5, the highest egg production of poultry is observed in April, ranging from 10.6 to 12.9 eggs per average laying hen.

From the first month of the egg-laying period, the geese of the third year of use had higher egg productivity indicators than geese of other groups. Thus, geese of this group gave 42.5 eggs per average laying hen during the egg-laying period, which is 2.5-10.3 eggs more than in groups 2 and 1, respectively.

Due to an increase in the females' age, geese of the second group took an intermediate position in egg production.

Thus, an increase in the age of female geese leads to an annual egg productivity increase, which is confirmed by the research of Salamon (2020).

The egg mass is influenced by heredity, age, individual characteristics of the organism and the maintenance and feeding conditions.

During the studied period, the egg mass of geese of the third year of use (group 3) was the largest of all the groups, amounting to 194.93 g. It was higher than in groups of geese of the first and second years of use. The age of the female geese justifies the lower egg weight.

The indicators of egg production per average laying hen and the weight of eggs when using male geese of the second year of use are presented in Table 6.

During the productive period, the intensity of egg production indicates the even character of the egg-laying process, proving the poultry's ability to resist harmful environmental influences and overcome them with minimal losses of egg productivity. Goose meat production is seasonal. Therefore, the highest egg production in the Southern Urals is possible in March and April.

Table 6 showed that the egg production of female geese when using male geese of the 2nd year of use was slightly higher than egg production, as shown in Table 7. A slight increase in egg production can be explained by the fact that the second year of use geese stressed the female geese less.

According to the Table, the highest egg weight in all groups (160.67-193.89 g) was obtained in

February and it gradually decreased with the duration of egg production.

This phenomenon can be explained by the fact that when egg production increases, the female organism has no time to restore the supply of nutrients with food.

According to Table 7, female geese of group 9 had the highest egg production capacity. It made 41.7 eggs per average laying hen, which is 8.6 eggs more compared to group 7. In May, all test groups were at their peak of egg production. In group 7, it amounted to 11.3 eggs. In the group of geese of the second year of use, egg production made 12.6 eggs and in groups 9 - 11.8 eggs.

In February, the highest egg weight in all groups was obtained at the beginning of the egg-laying period. It was more than 160 g in experimental group 7 and more than 190 g in group 9. It was revealed that the egg mass gradually decreased over the months of the egg-laying period. However, the thing to note is that the weight of a goose egg is mainly within the breed standard.

The table data indicate that the male geese of the 4th year of use didn't affect the egg production of female geese.

The same trend was maintained when using geese of the fourth year of use, as shown in Table 5, 6 and 7.

Thus, the egg production per average laying hen increases with an increase in the age of female geese. There was no significant influence of the age of male geese on the egg-laying indicators of female geese.

As seen in Table 8, the egg mass increases with increased female geese' live weight and age.

Thus, the weight of an egg is more influenced by such factors as heredity, age, individual characteristics of the organism. The created feeding and maintenance conditions also have a significant impact.

Table 1: Live weight (g) of party 1 geese during the egg-laying period

	Geese of the first year of use		
Egg-laying months	Group 1	Group 2 Males	Group 3
February	5,239.9±67.4	5,223.6±47.9	5,241.7±62.3
March	5,157.6±73.9	5,146.2±63.7	5,163.6±63.7
April	5,071.4±82.6	5,056.4±73.6	5,080.1±72.4
May	4,962.7±75.2	4,942.6±74.7	4,959.7±80.3
June	4,888.3±69.3	4,867.7±67.6	4,879.8±59.9
Average	5,063.9±71.7	5,057.9±77.9	5,065.8±74.8
Females			
February	4,820.7±68.7	5,080.1±64.1*	5,272.3±68.7**
March	4,728.2±67.4	4,978.8±69.8*	5,195.2±58.1**
April	4,692.9±59.5	4,942.5±67.5*	5,012.9±59.5**
May	4,511.8±57.1	4,807.5±66.4*	4,971.4±77.5**
June	4,526.6±59.7	4,766.5±55.9*	4,902.6±49.8**
Average	4,656.0±62.6	4,925.8±67.3*	4,996.0±73.1**

*=P<0.05, **P<0.01

Table 2: Live weight (g) of party 2 geese during the egg-laying period

	Geese of the second year of use		
Egg-laying months	Group 4	Group 5 Males	Group 6
February	6,059.5±67.9	6,056.7±65.9	6062.2±56.3
March	5,967.6±74.5	5,932.3±76.3	5945.6±66.4
April	5,879.5±78.9	5,835.7±87.3	5825.9±57.9
May	5,763.6±75.8	5,734.5±59.8	5753.1±62.3
June	5,689.5±74.9	5,647.3±67.4	5651.4±62.9
Average	5,889.7±79.3	5,874.8±72,4	5879.1±77.3
Females			
February	4,834.4±76.6	5,089.1±65.9*	5278.9±87.2**
March	4,734.2±56.9	4,967.9±67.2*	5193.8±79.9**
April	4,687.9±67.2	4,951,8±72.4*	5020.9±81.4**
May	4,583.4±62.7	4,823.1±74.2*	4987.3±72.6**
June	4,517.4±78.4	4,754.8±73.8*	4912.8±79.9**
Average	4,666.0±62.6	4,947.8±70.4*	5013.6±79.7**

*=P<0.05, **P<0.01

Table 3: Live weight (g) of party 3 geese during the egg-laying period

Egg-laying months	Geese of the third year of use		
	Group 7 Males	Group 8	Group 9
February	6,564.5±77.5	6,556.7±65.9	6,575.2±76.4
March	6,423.6±63.8	6,432.3±76.3	6,456.9±78.7
April	6,321.5±77.2	6,335.7±87.3	6,345.3±75.3
May	6,245.5±67.8	6,234.5±59.8	6,212.9±78.1
June	6,156.8±59.9	6,147.3±67.4	6,142.9±73.7
Average	6,087.2±78.2	6,074.8±72.4	6,072.1±74.2
Females			
February	4,856.1±82.1	5,091.4±78.4*	5,274.8±78.3**
March	4,754.4±75.2	4,975.2±76.2*	5,191.1±73.4**
April	4,662.1±77.5	4,963.3±73.8*	5,031.3±80.1**
May	4,578.9±73.9	4,834.4±77.2*	4,982.8±78.4**
June	4,519.4±75.3	4,765.2±75.8*	4,921.0±72.2**
Average	4,668.9±76.5	4,949.8±76.5*	5,056.3±77.8**

*=P<0.05, **P<0.01

Table 4: Live weight (g) of party 4 geese during the egg-laying period

Egg-laying months	Geese of the fourth year of use		
	Group 10	Group 11 Males	Group 12
February	6,778.2±87.2	6,763.9±83.5	6,771.9±78.9
March	6,665.4±87.9	6,674.8±83.1	6,659.8±80.4
April	6,405.4±84.9	6,412.4±81.9	6,413.3±88.0
May	6,345.6±78.5	6,349.3±80.2	6,351.1±81.2
June	6,256.3±80.4	6,249.8±79.9	6,245.2±79.8
Average	6,587.2±85.6	6,575.9±82.5	6,579.4±81.2
Females			
February	4,877.3±76.6	5,101.1±72.1*	5,287.1±82.1**
March	4,767.2±72.3	4,967.2±74.3*	5,201.4±80.2**
April	4,659.9±74.7	4,972.2±70.9*	5,165.5±79.4**
May	4,569.8±72.4	4,842.1±78.5*	5,003.9±75.5**
June	4,517.9±75.3	4,770.0±76.4*	4,931.6±77.6**
Average	4,674.7±73.5	4,965.8±73.9*	5,065.3±76.9**

*=P<0.05, **P<0.01

Table 5: Egg production, egg weight (g) per average laying hen party 1

Egg-laying months	Geese of the first year of use		
	Group 1	Group 2	Group 3
February	2.6±0.65	3.4±0.75	3.9±0.82*
	163.83±2.34	184.17±2.34	194.93±2.26
March	6.3 ±0.63	10.5±0.65*	10.6±0.78**
	161.92±2.18	172.32±2.17	182.68±2.07
April	10.6±0.75	12.3±0.81*	12.9±0.84**
	158.77±2.17	169.38±2.58	179.91±2.27
May	10.3±0.56	11.1±0.73**	11.8±0.87**
	155.86±2.08	166.18±2.32	176.73±2.19
June	2.40±0.48	2.5±0.86	3.3±0.78*
	152.89±2.36	163.41±2.54	173.86±2.40
Total	32.20±0.62	40.8±0.79**	42.5±0.81*
Average	158.65±2.47	169.09±2.36	179.62±2.54

*=P<0.05, **P<0.01

Table 6: Egg production, egg weight (g) per average laying hen party 2

Egg-laying months	Male geese of the 2nd year of use		
	Group 4	Group 5	Group 6
February	2.7±0.75	3.5±0.67	4.1±0.55**
	160.67±2.11	183.78±2.32	193.89±2.45
March	6.4 ±0.87	11.5±0.72*	10.2±0.83**
	157.78±2.22	176.31±2.43	179.45±2.16
April	10.7±0.67	11.6±0.84*	12.4±0.78**
	156.04±2.45	166.76±2.76	178.98±2.32
May	10.5±0.62	12.4±0.74**	12.6±0.83**
	154.76±2.42	165.93±2.56	176.54±2.23
June	2.6±0.56	2.7±067	3.5±0.58*
	151.98±2.56	162.91±2.78	173.98±2.67
Total	32.9±0.62	41.7±0.82**	42.8±0.81*
Average	157.89±2.26	168.34±2.45	179.31±2.49

*=P<0.05, **P<0.01

Table 7: Egg production, egg weight (g) per average laying hen party 3

Egg-Laying months	Male geese of the 3rd year of use		
	Group 7	Group 8	Group 9
February	2.9±0.47	3.4±0.43	3.7±0.43
	162.75±2.41	184.45±2.39	194.23±2.76
March	6.5±0.77	10.9±0.56*	10.9±0.53*
	160.89±2.56	173.01±2.19	183.27±2.56
April	10.0±0.73	11.8±0.67*	11.7±0.64*
	155.77±2.17	169.11±2.74	178.78±2.89
May	11.3±0.69	12.6±0.69**	11.8±0.71**
	155.16±2.49	165.76±2.43	175.98±2.52
June	2.4±0.61	2.8±056	3.6±0.39*
	153.17±2.53	162.91±2.19	172.99±2.76
Total	33.1±0.62	41.5±0.63**	41.7±0.61**
	158.92±2.42	168.88±2.29	178.88±2.23

*=P<0.05, **P<0.01

Table 8: Egg production, egg weight (g) per average laying hen party 4

Egg-Laying months	Male geese of the 4th year of use		
	Group 10	Group 11	Group 12
February	2.4±0.45	3.3±0.42	4.0±0.57*
	163.56±2.19	185.90±2.71	195.23±2.81
March	7.2 ±0.56	10.4±0.65*	11.3±0.75*
	160.84±2.42	174.54±2.72	183.03±2.54
April	11.1±0.59	12.8±0.76*	11.6±0.73*
	157.98±2.78	170.33±2.87	178.71±2.43
May	10.2±0.58	11.9±0.65**	10.7±0.75**
	156.07±2.41	167.22±2.56	175.81±2.56
June	2.3±0.47	2.9±041	3.6±0.49*
	153.19±2.81	162.67±2.87	174.29±2.41
Total	33.2±0.52	41.3±0.56**	41.2±0.68**
Average	158.12±2.66	169.87±2.77	179.81±2.62

*=P<0.05, **P<0.01

Discussion

The crossing of male geese of different ages with females of the first, second and third years of use affected geese' productive and reproductive qualities. During the analyzed period, geese of experimental groups 4-6, where male geese of the second year mated with female geese of the 1st, 2nd and 3rd years of use, were characterized by a high survival rate. Thus, the survival rate of geese in these groups

averaged 95.8%, which was 2.0-6.2% higher than the same indicators of other groups.

The live weight of geese in all groups during the research met the breed standard. Since February, negative dynamics of live weight were observed in males and females by the end of the productive period. The most severe loss of live weight of geese was in the middle of the egg-laying period. When getting older during the productive period, female geese were losing more live weight.

With advancing females age, the egg production per average laying hen increased. From the first month of the egg-laying period, the egg productivity of geese of the third year of use was higher than in other groups. Geese of these groups gave about 42.05 eggs per average laying hen during the egg-laying period, which is 2.5-10.3 eggs more than in other groups. There was no significant influence of the age of male geese on the egg-laying indicators of female geese. The revealed regularity is consistent with the research of Sukhanova *et al*. (2017) and Salamon (2020).

With an increase in the live weight and age of female geese, the egg mass also increases. The mass of eggs laid by females of the third year of use averaged 179.32 g over the productive period, 20.2 g higher than female geese of the first year of use. Chinese scientists Liu *et al*. (2021) obtained similar results when conducting studies in geese of another breed.

Conclusion

Comprehensive analysis showed that the productive and reproductive qualities of geese increase with age. The best productive indicators were shown by geese of the parent flock of a large grey breed of the third year of use. fig During the productive period, these geese gave 42.5 eggs, 2.5-10.3 eggs more than in other age groups. The weight of their eggs also increased, which amounted to 179.62 g, which is 6.5 13.2% more than in geese of other age groups. The age of the male geese did not significantly affects these indicators.

Funding Information

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Author's Contributions

Danis Khaziev, Rinat Gadiev and Marina Kazanina: Material preparation, data collection and analysis.

Albert Farrakhov, Alfiya Gayfullina and Alexandra Andreeva: Wrote the first draft of the manuscript.

Ethics

The research was conducted ethically. The research was approved by the local ethics committees of Federal State Budgetary Education Institution of Higher Education "Bashkir State Agrarian University".

References

Andreeva, A. V., Nikolaeva, O. N., Ismagilova, E. R., Tuktarov, V. R., Fazlayev, R. G., Ivanov, A. I., Altynbekov, O. M., Sultangazin, G. M., Urmanov, I. M., & Khakimova, A. Z. (2018). Effect of probiotic preparations on the intestinal microbiome. Journal of Engineering and Applied Sciences, 13, 6467-6472. doi.org/10.3923/jeasci.2018.6467.6472

Belkot, Z., & Pyz-Lukasik, R. (2011). Influence of the age of geese on chemical and organoleptic properties of fat. Medycyna Weterynaryjna, 67(12), 843-846.

Biesiada-Drzazga, B., Banaszewska, D., Charuta, A., & Koncerewicz, A. (2016). Influence of age on egg characteristics and reproduction features of Koluda® White geese. Europ Poult Sci, 80, 13. doi.org/10.1399/eps.2016.142

Gabitov, I. I., Badretdinov, I. D., Mudarisov, S. G., Khasanov, E. R., Lukmanov, R. L., Nasyrov, R. R., & Pavlenko, V. A. (2018a). Modeling the process of heap separation in the grain harvester cleaning system. Journal of Engineering and Applied Sciences, 13(S8), 6517-6526.

Gabitov, I. I., Yukhin, G. P., Martynov, V. M., Galiullin, R. R., Kostarev, K. V., Negovora, A. V., & Baltikov, D. F. (2018b). Modeling the power plant operation to optimize the technological and design parameters of the gas generator unit. Journal of Engineering and Applied Sciences, 13(S11), 8857-8864. doi.org/10.3923/jeasci.2018.8857.8864

Liu, G., Zhao, X., Chen, Z., & Guo, Z. (2021). A meta-analysis on the relationship between goose age and egg weight. Journal of Applied Poultry Research, 30(3), 100170. doi.org/10.1016/j.japr.2021.100170

Salamon, A. (2020). Fertility and hatchability in goose eggs, A review. Int. J. Poult. Sci, 19(2), 51-65. doi.org/10.3923/ijps.2020.51.65

Sukhanova, S. F., Azaubayeva, G. S., & Leshchuk, T. L. (2017). The main factors influencing the productive and biological indicators of the geese of the parent herd. Bulletin of the Kurgan State Agricultural Academy, 3, 48-53.

Tagirov, K., Gubaidullin, N. M., Fakhretdinov, I. R., Khaziakhmetov, F. S., Avzalov, R. K., Mironova, I. V., ... & Gizatova, N. V. (2018). Carcass quality and yield attributesvof bull calves fed on fodder concentrate" Zolotoi felutsen". Journal of Engineering and Applied Sciences, 13(S8), 6597-6603. doi.org/10.3923/jeasci.2018.6597.6603

Yalcin, S., Onbasilar, E., & Ramay, M. (2020). Effects of slaughter age and cage type on carcass and meat characteristics of laying hens. European Poultry Science, 84. doi.org/10.1399/eps.2020.310