Reproductive Qualities of Broiler Breeders When Using Various Technological Equipment

V N Khaustov¹, E V Piliukshina¹*, V V Rusanova¹, A S Popelyaev¹,
V N Getmanets¹

¹Altai State Agricultural University, 98, Krasnoarmejskij ave., Barnaul, 656049, Russia

E-mail: lexx-74@bk.ru

Abstract. Nowadays, poultry farms use various technological equipment for keeping and caring for poultry. This also applies to the feeding system. The studies were carried out in the conditions of Kamenskaya Poultry Farm LLC, Altai Territory, on the parent flock of the Ross 308 cross. For the experiment, two experimental groups of birds at the age of 23 weeks, 8355 heads each, were formed from the parent flock. The first group of chickens was fed from traditional, stationary trough feeders. In the second group, a new design of feeders was used - oval in shape, which automatically rose to the ceiling after feeding the birds. In this position, they are filled for the next bird feeding. It was found that the yield of broilers per the initial hen of the parent flock differs between the control and experimental groups (in favor of the experimental group) in all control periods. At the same time, the greatest differences were noted starting from the age of 47 weeks - 3.2%, at 52 weeks - 4.1%, at 57 weeks - 4.8%, and at 62 weeks - 4.1%.

1. Introduction
World and domestic poultry farming are the leading branch of animal husbandry in providing the population with a highly valuable and dietary food product - meat [1].

In our country, poultry farming is developing dynamically and is a science-intensive, highly developed branch of animal husbandry. The importance of this industry is caused by the high early maturity of poultry and low feed costs for produced products. Thanks to this, poultry products are basic in ensuring the food security of our country [2, 3, 4, 5].

The volume of poultry meat production in 2019 reached the level of 5.020 million tons. Russia ranks fifth in the world ranking. At the same time, in the domestic production of all types of meat, poultry accounts for 46.4%. The level of poultry meat production in Russia is sufficient for self-sufficiency, but there is a need to increase the export of this product [6, 7, 8, 9].

Increasing the production capacity of poultry enterprises in our country is a strategic task. At the same time, it is important to improve poultry keeping technologies based on the use of an innovative machine system, which takes into account the biological potential of crosses [10, 11, 12, 13, 14].

Broiler breeders are the most important part of the poultry meat production process. The main task of the breeder flock is to produce sufficient and fertilized hatching eggs. The final result of the meat production enterprise depends on the productive and reproductive qualities of this flock.
Consequently, it is necessary to create optimal conditions for feeding and keeping broiler breeders [15, 16, 17, 18]. Nowadays, 90% of broiler breeder birds are kept using floor equipment. The sets of such equipment include: belt conveyors for collecting eggs, nests, perches, bunker and trough feeders, drinkers, etc. Moreover, these mechanisms can be with different levels of performance of the required function, and for example, feed lines can be both with automatic lifting to the ceiling (when the bird is not fed) and without lifting. Both domestic and foreign companies produce equipment for parent flock. Recently, poultry farms have begun to complete a set of equipment from different manufacturers and suppliers.

Therefore, the identification of the effectiveness of the use of various technological equipment in the conditions of specific farms is an urgent area of research.

The aim of our work is to study the influence of some feeding systems on the reproductive qualities of hens in a broiler breeder flock.

2. Materials and methods
The studies were carried out in the conditions of Kamenskaya Poultry Farm LLC, Altai Territory, on poultry of the parent flock of the Ross 308 cross.

From the diagram (Table 1), it can be seen that for the experiment, two experimental groups of birds at the age of 23 weeks, 8355 heads each, were formed from the parent flock. The first group of chickens was fed from traditional, stationary trough feeders. In the second group, a new design of feeders was used - oval in shape, which automatically rose to the ceiling after feeding the birds. In this position, they are filled for the next bird feeding.

| Group              | Age of chickens, weeks | Feeding system                                      |
|--------------------|------------------------|----------------------------------------------------|
| First control      | From 23 to 62          | Trough feeders, stationary ones                     |
| Second experimental| From 23 to 62          | Oval feeders with automatic lifting to the ceiling after feeding |

All other (except for the feeding system) conditions of feeding and keeping the experimental birds were identical and corresponded to the requirements for this cross.

In the course of the study, the indicators of the reproduction of the experimental bird (egg production, egg fertilization, broiler yield) and the livability of layers were taken into account [19]. Some statistical data were processed using the Microsoft Excel package [20].

3. Results
An important indicator of the productivity of the parent flock is the yield of hatching eggs, which is presented in Table 2.

| Age, weeks | Norm | First control group | Second experimental group |
|------------|------|---------------------|--------------------------|
| 27         | 13.3 | 12.1                | 12.2                     |
| 32         | 41.5 | 40.9                | 41.7                     |
| 37         | 68.4 | 69.2                | 70.5                     |
| 42         | 93.4 | 95.9                | 98.1                     |
| 47         | 116.3| 111.9               | 123.9                    |
| 52         | 137.2| 141.4               | 147.5                    |
| 57         | 156.2| 161.0               | 168.8                    |
| 62         | 173.7| 177.2               | 185.4                    |
| 27-62 (from all livestock) | - | 1481210 | 1610310 |
The data in Table 2 indicate that the yield of hatching eggs in the experimental groups generally exceeded the normative level. At the same time, in the second experimental group, this indicator at 62 weeks of age was higher than in the control one (177.2 pcs.) by 4.6%. During the experimental period, 1610310 hatching eggs were obtained from the second experimental group, which is 8.7% more than in the first control group.

The weight of eggs from birds of the experimental groups is given in Table 3. According to the existing requirements for the parent flock of the Ross 308 cross, the weight of eggs ranges from 46.0 to 70.5 grams (depending on the age of the bird).

### Table 3. Egg weight, gram.

| Age, weeks | Norm     | First control group | Second experimental group |
|------------|----------|---------------------|--------------------------|
| 23         | 46.0     | 42.7±0.94           | 46.0±0.89                |
| 27         | 55.0     | 55.2±0.72           | 55.2±0.78                |
| 32         | 59.8     | 59.4±0.93           | 59.7±0.96                |
| 37         | 62.5     | 61.9±0.85           | 62.0±0.81                |
| 42         | 64.4     | 64.4±0.81           | 64.0±0.94                |
| 47         | 66.1     | 66.5±0.99           | 65.9±0.87                |
| 52         | 67.9     | 68.3±0.79           | 67.6±0.76                |
| 57         | 69.4     | 69.7±0.98           | 69.1±0.88                |
| 62         | 70.5     | 70.5±0.96           | 70.2±0.89                |

In our studies, the weight of eggs in the experimental groups was: at the beginning of the experiment (age 23 weeks) - 42.7-46.0, and at the end of the experiment (age 62 weeks) - 70.2-70.5 grams. Thus, the weight of eggs of hens in the experimental groups basically met the regulatory requirements. And there were no significant differences in this indicator between the control and experimental groups (p≤0.95).

Fertilization of hatching eggs is one of the important indicators of the reproductive ability of a bird, which is shown in Table 4.

### Table 4. Fertilization of eggs, %.

| Age, weeks | First control group | Second experimental group |
|------------|---------------------|--------------------------|
| 27         | 96.2                | 97.0                     |
| 32         | 97.6                | 98.2                     |
| 37         | 99.0                | 97.8                     |
| 42         | 93.0                | 97.8                     |
| 47         | 93.5                | 95.8                     |
| 52         | 90.8                | 93.6                     |
| 57         | 82.5                | 83.9                     |
| 62         | 69.0                | 75.0                     |
| 27-62      | 91.7                | 93.2                     |

From the given data it follows that the fertilization of eggs in the test groups was at the level of 69.0-98.2%. In the first three age periods (27-37 weeks), this indicator was the highest 96.2-99.0%. By the end of the exploitation of laying hens (62 weeks of age), this indicator decreased to 69.0-75.0%.

For the entire experimental period (age 27-62 weeks), the fertilization of eggs in the second group was 93.2%, which is 1.5% more than in the first control group. For such indicator as fertilization, this is a significant difference.

The most significant and final indicator that determines the reproductive capacity of poultry is the yield of broilers per the initial layer (table 5).
Table 5. Yield of broilers per the initial layer, heads.

| Age, weeks | First control group | Second experimental group |
|------------|---------------------|--------------------------|
| 27         | 9.6                 | 10.0                     |
| 32         | 35.5                | 36.4                     |
| 37         | 61.3                | 62.6                     |
| 42         | 85.4                | 87.4                     |
| 47         | 106.6               | 110.1                    |
| 52         | 124.3               | 129.5                    |
| 57         | 138.2               | 144.9                    |
| 62         | 147.2               | 153.3                    |

The yield of broilers per the initial laying hen of the parent flock differs between the control and experimental groups (in favor of the experimental group) in all control periods. At the same time, the greatest differences were noted starting from the age of 47 weeks - 3.2%, at 52 weeks - 4.1%, at 57 weeks - 4.8% and at 62 weeks - 4.1%.

In the process of keeping poultry of the parent flock, chickens are culled or die. The livability of hens of the parent flock in the test groups is shown in Table 6.

Table 6. Livability of test birds.

| Indicator                       | Age, weeks | First control group | Second experimental group |
|---------------------------------|------------|---------------------|--------------------------|
| Initial stock of chickens, heads| 23         | 8355                | 8355                     |
| Disposal of birds, heads        | 23-62      | 819                 | 575                      |
| Final livestock of chickens, heads| 62         | 7536                | 7780                     |
| Livability,%                    | 23-62      | 90.1                | 93.1                     |
| Difference with control,%       | 23-62      | -                   | 3.0                      |

From table 6 it follows that the initial livestock in the groups was 8355 heads in each one. During the period of operation, the disposal in the first control group was 819 heads, which is 244 heads more than in the experimental group (575 heads). The livestock at the end of the experiment (age 62 weeks) was: in the first control group - 7536 heads, and in the second experimental group - 7780 heads. Livability is an indicator that reflects the percentage of birds that survived during the production period. In our studies, it was greatest in the second experimental group and amounted to 93.1%, which is 3.0% more than in the first control group.

The increase in a number of productivity indicators in poultry of the second experimental group in comparison with the first control group can be explained as follows: 1. Due to the raising of the feeding system to the ceiling (after feeding the bird), part of the house is freed from darkening and obstacles for the passage of birds to the nests. The stocking density decreases, the number of eggs laid on the floor decreases, and as a result, the number of hatching eggs increases. 2. Poultry rationed feeding is carried out more accurately. In this case, the filling of the feeders with the required dose of feed occurs when the line is at the top. The bird does not see this and behaves calmly. During feeding, the line goes down to the birds receiving the necessary portion of feed.

In the first control group with a stationary (no lifting) trough feeding line, there is no such advantage.
4. Conclusions
Thus, the use of an innovative feeding line (oval feeders with automatic lifting) for broiler breeders improved their reproductive qualities and increased poultry livability.

5. References
[1] Fisinin V I 2013 Poultry farming in Russia and the world: state and challenges of the future *Animal husbandry in Russia* 6 pp 2-4
[2] Fisinin V I 2009 Poultry in Russia - an innovative development strategy (M.: RAAS) 148 p
[3] Fisinin V 2014 Achievements and tasks of the Russian poultry industry *Animal husbandry of Russia* 3 pp 2-5
[4] Bobyleva G A 2015 Ensuring the achievement of the intended goals *Poultry and poultry products* 1 pp 8-9
[5] Bobyleva G A 2011 Market of meat and poultry: state and prospects *Meat technologies* 5 pp 43-45
[6] Bobyleva G A, Gushchin V V 2020 Entering the new 2020 we summarize and define the tasks for the future *Poultry and poultry products* 1 pp 4-6
[7] Kornienko A V 2015 State, trends and measures to improve food security in Russia *Zootechnics* 7 pp 2-4
[8] Chirkov E 2001 Factors of increasing the economic efficiency of poultry farming (Agribusiness: Economics, management) 2 pp 30-35
[9] Altukhov A I 2008 Modern problems of ensuring food security in Russia and ways to solve them (Agrarian Russia) 2 pp 2-13
[10] Buyarov A V 2015 Priority areas for the development of poultry meat in Russia *Vestnik of the Altai State Agrarian University* 6 pp 165-171
[11] Buyarov V S 2003 Technological and economic aspects of broiler meat production *Zootechnics* 9 pp 24-27
[12] Buyarov V S 2009 Resource-saving methods and techniques for increasing the efficiency of broiler meat production *Vestnik of the Orel State Agrarian University* 2(17) pp 54-60
[13] Fisinin V I 2014 Innovative and technological development of poultry farming in Russia *Vestnik of the Orel State Agrarian University* 5 pp 141-150
[14] Khaustov V N, Zhukov V M, Rastopshina L V 2002 Simulators for broiler chickens *Poultry* 4 pp 28
[15] Sabine G, Gebhardt-Henrich, Michael J Toscano, Hanno Würbel 2018 Use of aerial perches and perches on aviary tiers by broiler breeders, Applied Animal Behaviour Science Vol 203 pp 24-33 https://doi.org/10.1016/j.applanim.2018.02.013
[16] Muhammad Shabir Shaheen, Shahid Mehmood, Athar Mahmud, Amjad Riaz 2020 Effects of different mating strategies in broiler breeder during peak and postpeak phase on subsequent broiler performance *Poultry Science* Vol 99 Issue 7 pp 3501-3510 https://doi.org/10.1016/j.psj.2020.03.038
[17] Saginbaeva N B, Bektursyn Zh M 2017 Keeping the parent flock of the Hubbard F15 cross in the conditions of Capital Projects LTD Innovations in science and practice: proceedings of the III international scientific and practical conference (Ufa: Dendra LLC) pp 130-141
[18] Lekrisompong N, Romero-Sanchez H, Oviedo-Rondón E O, Brake J 2014 Effects of feeder space allocations during rearing, female strain, and feed increase rate from photostimulation to peak egg production on broiler breeder female performance *Poultry Science* Vol 93, Issue 5 pp 1045-1052 https://doi.org/10.3382/ps.2013-03219
[19] 2015 Research methodology for the production of eggs and poultry meat Ed. V S Lukashenko Sergiev Posad: All-Russian research veterinary institute of poultry farming 103 p
[20] Lakin G F 1990 Biometrics: a tutorial (M.: Higher school) 352 p