IJABR

International Journal of Advanced Biotechnology and Research (IJABR)
ISSN 0976-2612, Online ISSN 2278–599X,
Vol-10, Issue-1, 2019, pp677-686
http://www.bipublication.com

Research Article

To conduct a comparative assessment of the morphometric parameters of chicken embryos of egg crosses with different egg shell color during the incubation period.

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[Received: 18/02/2019; Accepted: 19/03/2019; Published: 20/03/2019]

ABSTRACT.
The relevance of the research In the incubation of poultry eggs, many specific features that open up great opportunities in managing the process of breeding birds. The incubation regimes are developed and continue to improve on the basis of the patterns of embryonic development of birds. At the present stage, zootechnical science has achieved significant success in improving the breeding, feeding and maintenance of agricultural poultry, which has formed highly productive and highly profitable poultry farming in the conditions of highly profitable poultry farming, the most important is the issue of improving technological parameters and improving product quality at all stages of production. The incubation of poultry eggs has many specific features that open up great opportunities in managing the reproduction process of birds. The incubation regimes are developed and continue to improve on the basis of the patterns of embryonic development of birds. Currently, in industrial poultry farming, the average value of hatching chickens is 80-85%. And this is on condition that all hatching eggs are pre-selected on the basis of external signs and egg mass. This means that in the industrial poultry industry, the assessment of hatching eggs, increasing hatchability, viability of young animals during artificial incubation does not lose its relevance .The purpose of the study is to conduct a comparative assessment of the morphometric parameters of embryos of chickens of egg crosses with different egg shell color during the incubation period.

Keywords: Incubation, breeding birds, morphometric parameters, chickens.

1. INTRODUCTION

Reproduction of poultry is impossible without eggs incubating. Further intensification of the poultry industry should be accompanied not only by an increase in the volume of egg incubation, but also by an increase in the quality indicators of its results. The purpose of incubation as a science is to find ways to increase the hatchability of eggs and the quality of day-old young stock (1).

The creation of high-yielding breeds and crosses of poultry with a modified genotype led to the need to study the biological characteristics of eggs, the embryonic development and hatched young stock in order to improve the entire incubation technology, and not just the modes. An important condition for this is the control system, which includes the quality control of hatching

eggs, the development of embryos, the quality of day-old young stock and its preservation in the first 10 days of growing. This control system is called biological control in incubation. All information obtained in the course of biological control, allows you to control breeding work, feeding the poultry, the conditions of its keeping, the veterinary state of the enterprise and the technology of incubation.

Biological control turns eggs incubation into an active creative process, and its proper and systematic implementation makes it possible to control the embryonic development of the poultry, get high quality young stock well prepared for further growing, predict the results of incubation and promptly eliminate the reasons for their decline, which in its turn increases the profitability of the poultry farm enterprises(3,17,18,19, 20).

Biological control is carried out in three stages(5,6). .Specific batches of eggs from known supply sources of 2-3 control trays from the batch, located in the upper, middle and lower zones of the incubator, are subject to control. In cases of composite batches (eggs from poultry of different herds), take two or three trays from each group and the results are compared (9,12).

Biological control includes standard procedures. Based on these standard procedures, a software have been created to regulate the physical parameters of the environment in the incubator in order to create favorable conditions for the development of the embryo. In the conditions of large-scale industrial production, this software is configured to maintain averaged environmental parameters. At the same time, an individual feature in the development of embryos of poultry with different genotypes is practically not taken into account (4,6,15,16) .

Relevance of the research topic. Incubation of poultry eggs has many specific features that open up great opportunities in managing the breeding process of poultry. The incubation modes are developed and continue to improve based on the patterns of embryonic development of poultry(2,4,8).

At the present stage, zootechnical science has achieved significant success in improving the breeding, feeding and keeping of agricultural poultry, which has formed a high yielding and highly profitable poultry farming [12,14,17).In the conditions of highly profitable poultry farming, the most important is the issue of improving technological parameters and improving product quality at all stages of production.

Incubation of poultry eggs has many specific features that open up great opportunities in managing the breeding process of poultry. The incubation modes are developed and continue to improve based on the patterns of embryonic development of poultry; (4,8, 21).

Nowadays, in the poultry industry, the average value of hatching chickens is 80-85%. Subject to all hatching eggs are pre-selected according to external features and egg mass. This means that in the poultry industry, the assessment of hatching eggs, increasing hatchability, and viability of young stock during artificial incubation does not lose its relevance (7, 22).

The purpose of the study - to conduct a comparative assessment of the morphometric parameters of chicken egg embryos of egg crosses with different eggshell color during the incubation period.Objectives of the study: to study the morphometric indicators of brown and white-shell incubated chicken eggs; evaluate the results of biological control of the development of the chicken embryo in eggs with different coloring of the shelland - analyze the results of incubation of chicken eggs with different ratios of mass and volume.

MATERIAL AND RESEARCH METHODS

The experimental part of the work was performed in the incubation laboratories of the Department of Veterinary Medicine of the Agrarian Technological Institute of the Peoples' Friendship University of Russia in the period from 2017 to 2018.

The material for the research was the eggs of the hens of the “Shaver Brown” cross (brown egg)

and “Shaver White” cross (white egg) obtained in LLC “Genofond” VNITIP. For the research, the eggs of the batches that had been previously evaluated by the specialists of the incubator workshop of LLC “Genofond” were selected taking into account the generally accepted requirements for incubation eggs. The shelf life of eggs is not more than 5 days.

At the first stage, a morphometric analysis of 10 eggs of each cross was made at each laid. At the same time, ovoscopic test of eggs was performed. The mass of eggs was determined on an electronic scale HR-200 (Japan), large and small diameters, as well as an egg shape index — using an ИМ-1 index meter. Ovoscopic tests performed with use of the Ovoskop ПКЯ-10. At the second stage of research, eggs were laid for incubation. Total performed 7 egg laying. For each incubation laid 10 eggs of the Cross "Shaver Brown" and "Shaver White". All eggs underwent ovoscopic test. At the third stage, all eggs laid for incubation were opened daily, with 3 eggs of each cross for opening. After opening, photographing of the embryos was performed. At the fourth stage, morphometry (measurement) of the embryos was performed using the GIMP software.

Incubation of chicken eggs was performed in R-COM KING SURO20 incubators.

In the process of incubation, the development of embryos was controlled by ovoscopic tests of eggs. Opening and photographing of embryos was performed daily. Embryo sizes were determined using graphical software - a graphical editor GIMP, using bitmap processing for individual pixels.

Statistical processing of the data obtained was carried out according to the guidelines for processing the results of measurement materials and material processing algorithms using the pack, and data analysis "MS Excel 2010" and the software "Statistics for Windows" (11).

Brief description of the productive indicators of the researched crosses.

“Shaver” crosses. General description. Chickens of Shaver Cross are for the egg production. Like other egg-breeding chickens, these are very mobile, small birds with light bones and dense plumage, as well as a well-developed crest and wattles. Chickens of this cross have a white, black or brown color. Chickens with different colors are called respectively: shaver white, shaver black and shaver brown. Hens begin to fledge very quickly, and cockerels are somewhat longer. At the age of one day you can already determine sex on the growth rate of the feather. In one day hens from cockerels can be distinguished by two brown stripes on the back. The hen's crest is leafy, of a bright red color, it stands erect in cockerels, and in hens it hangs slightly to one side. The eyes of the birds are rather expressive, very lively, with a bright dark orange iris in young hens and a paler one in adult specimen. Earrings are usually medium in size, slightly rounded and red. Earlobes of birds are white. The beak is rather long and strong, yellow. The neck is short, curved. Roosters have a proud posture. Their breasts are convex and round, and the pectoral muscles are rather well developed. The back is slightly elongated and concave in the middle. The abdomen of birds, especially of hens, is very voluminous. Legs are bare, without plumage, of medium length. In young birds, they are yellow or light orange in color, in more mature and productive birds become white, with a slight bluish tinge. The tail of the hens is slightly lowered, while the roosters are raised (10,14).

Cross features. Poultry are very disease resistant. The latest breeding development has allowed to get chickens that do not suffer from neoplastic diseases, including leukemia, Marek's disease and reticulo endotheliosis. The laying period is very long - about 80 weeks. The eggs of this cross contain a large amount of healthy Omega-3 acids, when flax seed is introduced into the nutrition of the bird. Laying birds are very calm and strong; they easily adapt to different climatic conditions. Very favorable feed conversion compared to other breeds of chickens. The eggshell is very smooth and durable. The rapid increase in egg mass during the productive period. Very high

production quality and stable performance. The average life expectancy of 3-4 years (4).

Keeping features. The cross is very strong, 96-98% of the chicks survive under proper care. 80–82% of young stock survive. It is very important to protect young chickens from drafts, because at a young age they are rather tender. On average, the bird consumes 100-110 g of feed per day. This is 5-10% less than chickens of other egg breeds. The bird is almost not picky in nutrition. However, it is important to maintain approximately the same level of caloric intake. On average, it should be 2900 kcal per kilogram of feed.

Cross "Shaver Brown". Cross - four-line, autosexing. The parental forms of AB and CD are sexually sliced at the age of one day based on the speed of growth of wing feathers: cockerels - slow- feathering, chickens - fast-feathering. The daily chickens of the paternal parental form AB are brown, the maternal form of CD is white. By crossing the cockerels of the paternal form AB with the hens of the maternal form of CD, they get the final hybrid, autosex in the color of fluff, at day old. The cockerels are mostly yellow in color, the hens are usually brown. Accuracy of sexing of daily young of the final hybrid is 99.0 - 99.5% (13).

Cross "Shaver White". Highly productive cross-egg breed, producing a large number of eggs with a relatively low feed intake. Specimen are characterized by increased viability and excellent egg quality. The safety of specimen reaches 95%. The sexual maturity of hens begins at 4 months of age. Half of the potential productivity of the hens reach at 20 weeks of age. The peak of egg production is observed from 27 to 46 weeks of life and is 235 eggs per year. The productive age lasts up to 90 weeks. The average egg weight is 62.9 g. The shell is strong, white. The average daily feed intake rate is 104 g. The maximum live weight of the hen is 1.67 kg (13) ,table 1.

Table 1. Comparative performance crosses.

INDICATOR	Shaver brown	Shaver White
Growing period	**0-17** weeks	**0-17** weeks
Safety,%	98-99%	97-98
Live weight at 18 weeks, kg	1,47	1,3
Feed intake (0-17 weeks), kg	5,90	5,41
Period of productivity	**18-80** weeks	**18-80** weeks
Egg production on the initial hen, pieces	349-352	342-352
Age at 50% productivity, weeks	19-20	21-22
Peak productivity,%	95-96	96-98
The average egg weight, g	63,2	60,0
Eggs Mass per initial hen, kg	22,1	21,3

RESEARCH RESULTS

Characterization of morphometric parameters of hatching eggs of hens. Eggs of the studied hens crosses had the form of an asymmetrical ellipse or Cassinian oval, one end of which is somewhat dumber than the other. The standard incubation chicken egg has the following parameters: mass 58.0 g, volume 53 cm3, density 1.09 g / cm3, long circumference 15.7 cm, short circumference 13.5 cm, shape index 74, surface area 68 cm2.

The results of the morphometric evaluation of eggs are presented in table 2.

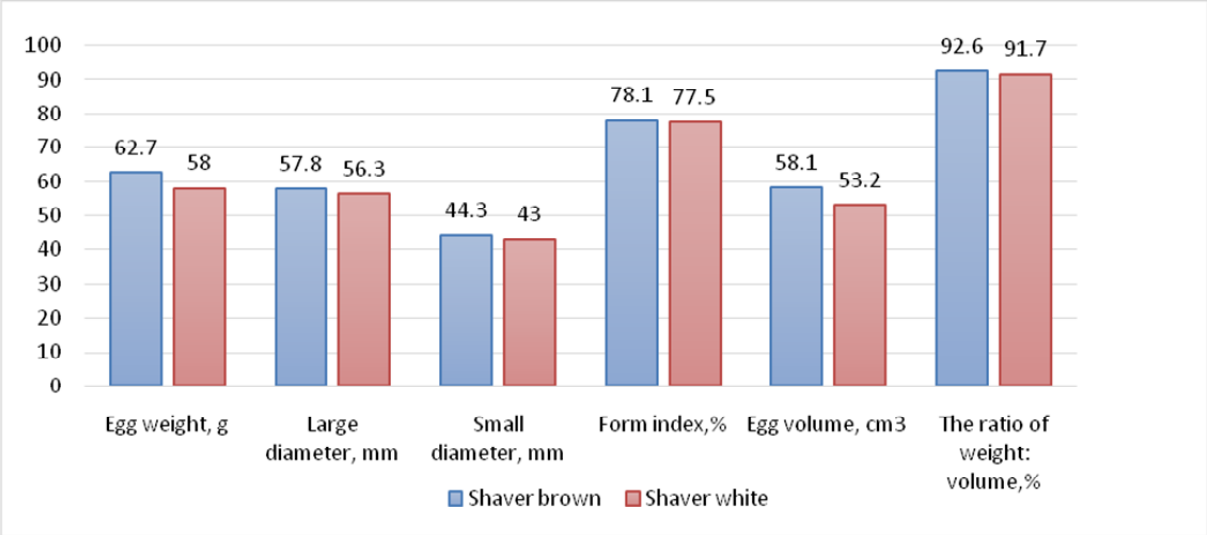
Processing the results of a preliminary assessment of the geometric indicators of hatching eggs (table 2 and figure 1) shows that the eggs according to the above parameters, mainly met the regulatory requirements.(table2).

Table2. Morphometric indicators of hatching eggs of chickens.

Indicator	Cross	
	Shaver brown (n=70)	Shaver white (n=70)
	M ± m	M ± m
Egg weight, g	**62,7**± 0,32	**61,0**± 0,16
Large diameter (BD), mm	**57,8** ± 0,22	**56,9** ± 0,13
Small diameter (MD), mm	**44,3** ± 0,22	**43,5** ± 0,07
Egg shape index,%:	**76,6** ± 0,28	**75,9** ± 0,22
Egg volume, cm3	**58,1** ± 0,36	**56,2** ± 0,21
The ratio of mass and volume, g / cm3	**1,079**± 0,043	**1,086** ± 0,021
Marbling, score	**2,9** ± 0,29	**2,6** ± 0,09

Based on the shape index value (an average of 76.0%), it can be stated that the eggs corresponded to the standard ovoid for the eggs. Brown eggshell eggs were on
average larger than white-shelled ones. They surpassed the white-shelled in mass by 1.7 g (P≥0.95), in large and small diameter, respectively, by 0.9 and 0.8 cm (P≥0.9). (figure 1).

Fig.1. Morphometric indicators of hatching eggs of chickens



This, in its turn, affected a larger volume of brown shell (58.1 cm3) compared with white shell (56.2 cm). In terms of the mass-to-volume ratio, the Shaver White cross eggs exceeded the Shaver Brown cross eggs by an average of 0.8%. In terms of marbling, the eggs examined did not have significant differences. Although it should be noted that the variability of the feature "marbling" in the eggs of the Shaver Brown cross was significantly higher.

Age-related changes in chicken embryos.

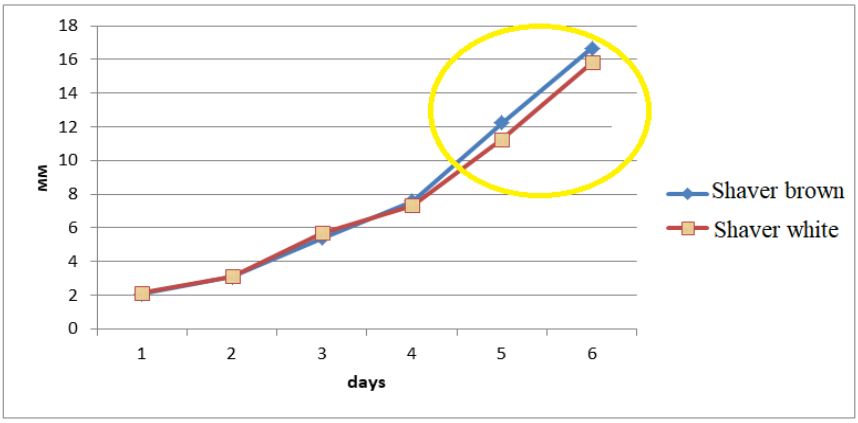
The appearance, size and structure of the embryo vary. If in the first days of incubation of the embryo, a neural tube, a notochord, and primary vertebrae characteristic of all vertebrates appear, then, later there are signs of a class of birds, species and breed features. The embryo also has temporary (provisional) organs located outside of its body and functioning only until the eggs are released. They are called embryonic shells. During embryonic development, a constant metabolism occurs between the embryo, the yolk, the protein and the shell, the characteristics of which change with age. The embryo assimilates the nutrients of the egg, releases and partially reserves in it the products of dissimilation, absorbs and releases heat. At the

opening of the eggs of both crosses before incubation, the fertilized disc had a rounded shape. In the center of the disk there was a clearly distinguishable transparent zone surrounded by an opaque whitish ring, the size of the blastodisc was 4 mm. By the end of day 1, 5-7 somites, blood islands are visible. The primary strip increases to 2.5 mm, and the germinal disc - to 3.5-5 mm.

By the end of day 2 a heart is formed. By the end of day 3, the head of the embryo is separated from the blastoderm, the rudiments of limbs appear, 28-40 pairs of somites are seen. By the end of day 4, the embryo is separated from the yolk and closed with amnion, you can see 48-50 pairs of somites. Begin to pigment the eyes. Allantois is like a bubble. Germ reaches 8 mm.

In the period from 4 to 6 days, a significant difference in the size of the embryos was noted. Moreover, although the embryos are still very small and poorly distinguishable, as they are immersed in the yolk, but during ovoscopic tests on the day 6, and at the opening, the well-developed and filled with blood vascular blood network of the yolk sac is seen. It can be noted that the embryos of both crosses develop normally, but the linear growth of the embryos of the brown shell cross is more intense. By the day 5, the Shaver Brown cross embryos significantly exceed the Shaver White cross embryos by an average of 8.8%, on the 6^{th} day - by 5.4%. (Figure 2).

Fig.2. Chicken embryo size at 1-6 days.



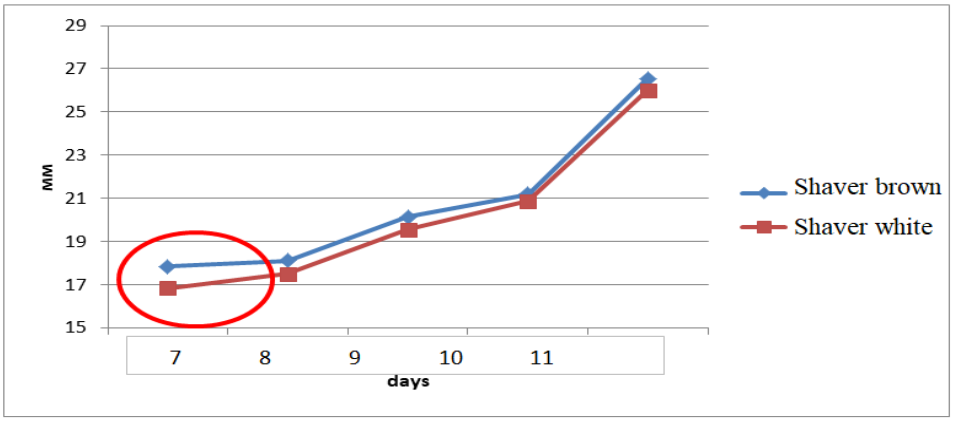
That is, it can be stated that the Shaver Brown cross embryos are characterized by more intensive growth in the period from 3 to 7 days of incubation. At the same time, the development of all the major organs and tissues of the Shaver White cross embryos is similar, but not as fast as in a quieter form. The head of the embryo reaches a considerable size, the body and neck are extended. Differentiation of the bones of the foot is observed in the rudiments of the limbs. The extracorporeal vascular field covers 2/3 of the surface of the yolk. The amount of amniotic and allantoic fluids is noticeably increased. Allantois covers more than 1/3 of the vascular field of the yolk sac .

On the day 7 of development, the difference averages 3.8% in favor of Shaver Brown cross embryos. By this age, the head takes the form characteristic for birds. The beak is elongated, the nostrils are noticeable and the egg tooth is more pronounced at the tip of the beak. The ulnar bend of the wing is clearly pronounced. The rudiments of feathers weakly protrude above the surface of the skin, along the middle region of the body, especially on the shoulder, neck, and on the skin of the thigh.

Between 8 and 11 days of incubation, a reverse trend is observed in the linear growth of embryos (Figure 3). During this period, the growth of embryos of the Shaver White Cross is accelerated, and it slows down the growth of Shaver Brown cross embryos. That is, the growth of the Shaver White cross embryos goes a little ahead.

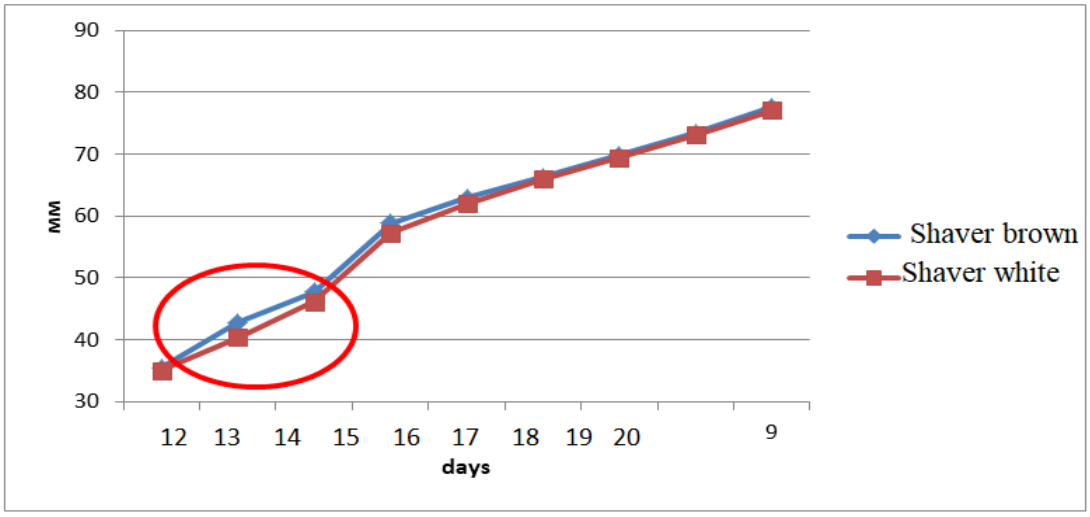
As a result of this, on the 12th day of incubation the embryo is practically compared in size. The difference is not statistically significant.(Figure 3).

Fig.3. Chicken embryo sizes at the age of 7-11 days



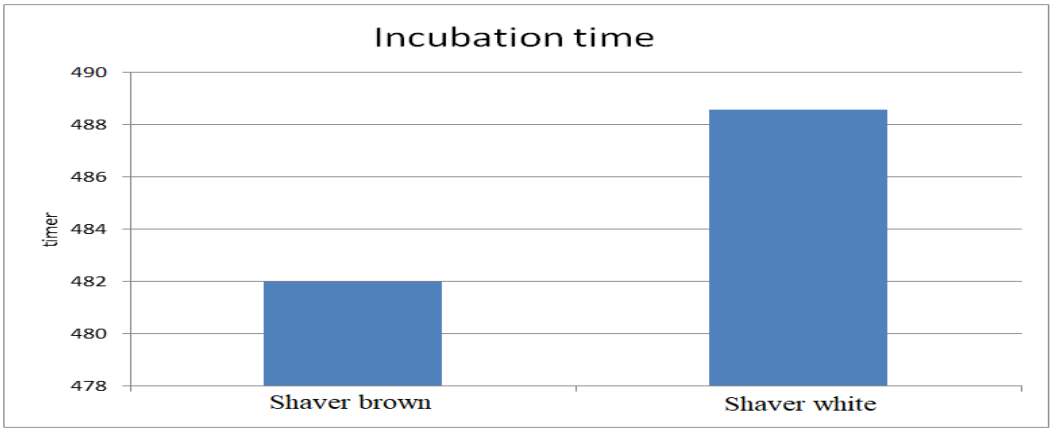
It can be stated that with enhanced formation of skeletal muscles in the period of 8-10 days, this process proceeds more actively in the Shaver White cross embryos. This is probably due to the fact that the hens of Shaver White cross were intensively selected for the development of muscles and this is a feature of the cross. By day 11, allantois reaches its maximum development. Its vascular network is clearly visible during ovoscopic test. Allantois closes at the sharp end of the egg and completely covers the yolk. Feather papillae covered the entire body of the embryo. In the period from 11 to 14 days, the again more intensive development of the Shaver Brown cross embryo (Figure 4).

Fig.4. Chicken embryo sizes at the age of 12-20 days.



A second wave of more intensive development of the embryo begins. During this period, the development of the kidneys, the digestive system, and the trachea and the pulmonary bags are differentiated. Body size of the Shaver Brown cross embryo during this period is on average 3.6% larger than the Shaver White cross embryo. The difference is statistically significant ($P>0.95$). In the future, the differences are smoothed out and by the day 18 of incubation, the embryos of both crosses are almost the same in size and exterior features. Embryos are covered with elongated fluff and have a transverse position with respect to the long axis of the egg. Amnion tightly fits the body of the embryo, because protein-amniotic mixture fully utilized. On the 21st day begins the hatching of chickens. It should be noted that, in brown-shell eggs, the curse of the shell was observed on average 4.6 hours earlier. The total duration of incubation of the Shaver Brown cross eggs was also 4.8 hours less (Figure 5).

Fig.5. Incubation time.



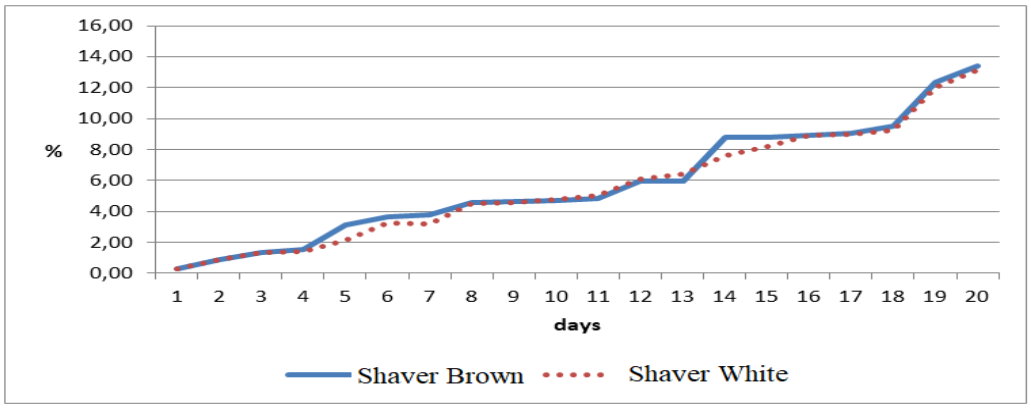
In general, it can be concluded that during the incubation period there are two periods of more intensive growth and development of embryos. In embryos of the Cross Shaver Brown it is 4-8 and 12-14 days. Embryos Shaver White cross 9-12 and 15-18 days. The time shift in growth intensity is 3-4 days.

Egg mass loss during incubation

Both large and insufficient mass loss of eggs adversely affects the development of embryos and the quality of young stock hatching (Kolikov,I.V. and Nikishov,A.A.(2006).Large losses in egg mass in the first week of incubation and small losses in the second half of the incubation period are very dangerous. According to the control of egg mass loss, it is possible to make adjustments to the incubation mode, and, in particular, to the humidity mode.

The dynamics of egg mass loss largely repeated the linear growth rate of embryos (Figure 6). During periods of intense growth of Shaver Brown cross embryos (4–8 days and 12–14 days), there was also a maximum loss of moisture. In the Shaver White Cross Eggs, these periods were 7-11 days and 15-18 days.(Figure 6).

Fig.6. Egg weight loss during the incubation period.



This is probably due to the acceleration of interstitial metabolism in the process of intense differentiation of individual tissues and organs during these periods. Ingeneral, the loss of moisture amounted to approximately 13.4%, which meet the standard parameters (6).

The protein content largely varied by modal classes. with an increase in the absolute value of the ratio "volume to masses. a decrease in the index trolley index value is observed from 0.09 to 0.06 and the value of the unit Howe from 87, 74 to 76.5, indicating a decrease in the quality of egg white. in

eggs with a smaller ratio of volume to mass, the quality of the yolk is significantly higher. in terms of yolk index, the difference averages 7% (P> 0.95).

H. Between the ratio of the volume of the mass of eggs and indicators of egg quality (protein index, Howe units, yolk index), a reliable average strength and inverse in the direction correlative dependence with fluctuations of the correlation coefficient is determined from - 0.34 to - 0.56).

In the modal classes, 91.5-93.0 and less than 91.5% were bred, respectively, by 8.5 and 4.7% more chickens compared to the modal class with a volume: weight ratio of more than 93%. In terms of hatchability, the differences were 1.4% and 3.0% respectively. a visual assessment of day-old calves did not show a significant difference in live weight between chickens, assigned to different modal classes.

ACKNOWLEDGEMENT

The paper was prepared with the support of RUDN University program 5—100.

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