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THE IMPORTANCE OF CONTROLLING INCUBATION FACTORS IN DUCK BREEDERS

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Abstract

The aim of this paper is to highlight the importance of having a good control of incubation factors of ducks because they are the key in obtaining high technological and economical results in duck husbandry. Incubation factors can be divided in two great categories: 1. reproduction factors (mating system, the technologies used in duck husbandry genetic quality of the birds, sex ratio in the flock, the age of the birds, etc.); 2. incubation factors (egg collection, egg storage, preheating, incubation temperature, humidity, ventilation and movements of the eggs). Having a very firm control of this factors, one can achieve good incubation results which, later, can be translated in to bigger production of meat (and secondary productions) and bigger income for the farmer.

Key words*: egg production, incubation, incubation factors, meat production, reproduction factors.*

INTRODUCTION

In duck husbandry, incubation is a must for obtaining good technological and economical results and is a very important step for the industrialisation of this sector of animal science, having in regard the higher and higher request of food that is accessible, of quality and diverse.

The incubation can be defined as being a set of operations which allow that, from a certain number of eggs, to be obtained a maximum number of ducklings at a minimum cost.

By knowing the interactions between reproduction and incubation factors, one can optimise the quantitative and qualitative production (meat, eggs, fatty liver (foie gras) and feathers).

The main factors that influence the outcome of incubation for ducks and were evaluated for this paper are shortly presented here.

Factors influencing reproduction:

The quality of ducks refers to the genetic potential of the individuals that are used for reproduction. Knowing the genetical potential of each individual is a must, because genetic improvement is the only way for getting economical quality of the production.

Mating system and breeding method. In the case of ducks, breeding is made by hausing together the male with females. It shuld be given a special attention to the risc of consangvinisation which determines a bad incubation index by greater embrion mortality. Opposite to that, the hibridation determines an increasing of hatching rates due to low embryonic mortality (Popescu-Miclosanu, 2007).

The age of individuals. Studies have revealed that eggs obtained from young females that are at their first cycle of laying are smaller and the fecundity is decreased. It is recommended that the individuals from the reproductive group to be as homogeneous as possible (Popescu-Micloșanu, 2007).

Table 1. The variability of eggs weight depending on breed and selection for incubation (Popescu-Micloșanu, 2007)

Breed	Weight variability (g)	Weight variability of incubation eggs (g)
Barbarie	80-90	85-90
Pekin	60-80	70-80
Indian Runner	65-80	70-80
Campbell	65-80	70-80

Another paper that reveles the importance of age in duck reproduction was publicated in Poultry Journal by Applagate et al. (1988). The results had shown that birds with a bigger age have produced eggs with higher weith and,

comparative with eggs from younger birds, have a better incubation index.

The date of the lot formation. For obtain a large number of effective matings and high fecundity, the lot is recommended to be done 4 to 6 weeks before the laying period starts, (Popescu-Miclosanu, 2004).
Sex ratio is recommended to be, for light breeds, 1 male for 5 females, and for heavy ones, 1 male for 4 females. Controlling this sex ratio determines a high fecundity (Tipurită, 1986).

Factors influencing egg incubation:
Egg gathering. In the case of palmipeds, egg gathering must be done several times a day, due to the fact that they can lay eggs not only in the nest but also on the floor. Eggs intended for incubation must not be cracked and have a clean shell.
Egg depositation. The storing of eggs for incubation must be done in a special room where the optimal temperature for egg storage is as in Table 2.

Table 2. Duration of storage of eggs depending on temperature (Popescu-Micloșanu, 2008)

Temperature (°C)	0	1	10
Duration of storage (days)	4	9	3

Humidity in the storage room is also very important and should be between 75-80%.
Care should be taken when the storage period exceeds one week. If this is the case, the stored eggs must be turned 2 to 6 times a day (Popescu-Miclosanu, 2007).
Preheating. It is known that embryonic development starts from 21°C, so preincubation involves heating the eggs at a temperature of 24 - 32°C with about 6 - 12 hours before being introduced into the incubator.
The incubation temperature should be between 37.5-38.0°C, and the optimal temperature is 37.7°C (Dinea, 2008). Decreasing the temperature under 35.5°C or raising it to more than 39.0°C leads to a high percentage of embryonic mortality. A study Harum et al. (2001) on Barbarie showed that the optimal temperature used in incubation that gave the most satisfying results was 37.5°C, when combined with daily spraying of eggs, and a 30-minute cooling per day.
Humidity. The recommended value in the incubator for duck eggs is between 55 and 60% and in the hatcher, even higher than 95%. When the humidity is too high, the weight of the ducklings grows, and when it is too low, the duckling may stick to the membranes and so, the hatch became impossible.
A study from 2012 on Pekin, presented in the journal Poultry Science by El-Hanoun et al. (2012), shows that the best incubation results were obtained at a relative humidity of 60%.
Ventilation is very important, fulfilling two functions: a) ventilation regulates the amount of fresh air introduced into the incubator by removing carbon dioxide and providing an adequate amount of oxygen; b) and the second function of ventilation is that it maintains the internal air circulation, preventing the temperature from rising and the accumulation of harmful gases in the incubator (Dinea, 2008).
The position and the turn of the eggs. The eggs may be placed in the incubator in a horizontal or vertical position according to the requirements of the incubator.
The turn of the eggs prevents sticking the yolk of the shell membrane. The turn can be done every two hours.

MATERIALS AND METHODS

In 2016, from the egg production of Barbarie, Pekin, Indian Runner and Campbell breeds from the Moara Domneasca Didactic Farm, after sorting, six series of 100 or 150 eggs per breed were incubated.
The data obtained in 2016, when all the incubation indices were respected (Table 3), were compared with data from 2015, when no special attention was paid to incubation technology (Table 4). Systematization and statistical analysis of data were done in Excel.

RESULTS AND DISCUSSIONS

For the Barbarie and Pekin breeds, 6 series of 100 eggs were introduced to the incubation, and 6 series of 150 eggs were introduced for the Indiana Runner and Campbell breeds.

Table 3. Data obtained in 2016 at the Moara Domneasca Didactic Farm

Breed	Eggs	Ducklings	Clear	Dead
Barbarie	600	306	168	126
Pekin	600	450	92	58
Indian Runner	900	530	226	144
Campbell	900	649	150	101

Table 4. Data obtained in 2015 at the Moara Domneasca Didactic Farm

Breed	Eggs	Ducklings	Clear	Dead
Barbarie	600	235	200	165
Pekin	600	388	126	86
Indian Runner	900	484	264	152
Campbell	900	600	155	145

In order to achieve these results, both factors influencing reproduction and that influencing egg incubation have been respected.

Factors influencing reproduction:

The quality of individuals. The groups of ducks (Table 5) were homogenous made from females that were at the second and third cycle of laying.

The birds from which hatching eggs were recolted were healthy, not presenting diseases or breeding problems.

Table 5. The breeding groups (heads)

Breed	Females	Males
Barbarie	40	10
Pekin	50	15
Indian Runner	50	15
Campbell	50	15

Mating system and breeding method. Birds were raised in pure lines, on the ground, in collective boxes.

The age. Groups were made from birds being at the second and third cycle of laying and a percent of 10 to 15% of birds being at the first cycle of laying that were selected having a optimum weight and being able to lay good quality eggs.

The date of lot formation. For the formation of the lot, a method suggested by Popescu Miclosanu in 2007, was used.

So, lot formation was made with about 5 weeks before the laying began, to produce intense mating and thus a high index of fecundity.

Sex ratio was as in Table 6.

Table 6. Sex ratio

Breed	Males / Females
Barbarie	1:4
Pekin	1:3
Indian Runner	1:3
Campbell	1:3

Factors influencing egg incubation:

Eggs collection was done 2-3 times a day, as follows: at 8 o'clock, at 10 o'clock and at 12 o'clock

Eggs storage. It was made in the storage room. The eggs were stored for 3 to 7 days depending on the laying season, the number of eggs or the formation of the series required for the incubation. The storage room fulfills the conditions presented in table 7.

Table 7. Parameters in the storage room (Dinea, 2008)

Duration	Temperature (°C)	Humidity (%)
1-3 days	18-21	75
3-7 days	15-17	75-80
> 7 days	12-14	80

Preheating. In the experiment conducted at the Didactic Farm, the preheating of each series of eggs was done with great care for 12 hours until they reached the temperature of 26°C.

The incubation temperature was 37.7-37.9°C, with no variation in the incubation period of each series.

Humidity in the incubator ranged between 65% and 70%, periodically checked, to intervene if necessary, using a complex device called thermo-anemo-lux-meter (Figure 1).

Figure 1. Thermo-anemo-lux-meter (http://www.intratechengineers.com)

In the hatchery, the humidity was 95%. The weight of the ducklings obtained was the normal one encountered in each of the four breeds.

Ventilation was appropriate, with an adequate gas exchange, not to endanger embryonic development.

The position and turn of the eggs. The incubator was a vertical one, and the turning of

the eggs was done by tilting. The turn was done every two hours.

Data analysis. After processing the data, we found the following:

- The greatest positive impact due to control of incubation factors was recorded in eggs from the Barbarie breed, which produced 30.20% more ducklings. In the Pekin breed, the increase was 16.00%, the Indian Runner 9.50%, and Campbell of only 8.20%.
- The most significant reduction in the percentage of clear eggs was recorded in the Pekin breed (-27.00%), and the least significant (-3.20%) in the Campbell breed. In the other two breeds, the percentage of clear eggs decreased by about 15% (Table 8).
- Percentage of embryo mortality was the lowest in Pekin (-32.60%) and Campbell (-30.30%), and in Barbarie and Indian Runner breeds was reduced with 23.60% and 5.30%, respectively.

Table 8. Synthesis of duck eggs incubation data obtained in the years 2015 and 2016 at the Didactic Farm

	Eggs		Ducklings			Clear			Dead		
	2015	2016	2015	2016	2016/2015	2015	2016	2016/2015	2015	2016	2016/2015
Barbarie	600	600	235	306	30.2%	200	168	-16.0%	165	126	-23.6%
Pekin	600	600	388	450	16.0%	126	92	-27.0%	86	58	-32.6%
Indian Runner	900	900	484	530	9.5%	264	226	-14.4%	152	144	-5.3%
Campbell	900	900	600	649	8.2%	155	150	-3.2%	145	101	-30.3%
Total	3000	3000	1707	1935	13.4%	745	636	-14.6%	548	429	-21.7%

For the precision of the interpretation of these data, three ANOVA single factor tests were performed: for the number of ducklings, number of clear eggs and number of eggs with embryonic death. The results showed that there was no significant difference between the two years of production for any of the categories.

The value of P was: for the number of ducklings of 0.609, for the number of clear eggs of 0.529, and for the number of embryonic death eggs of 0.289.

CONCLUSIONS

The analysis of the results presented in Tables 3 and 4 shows that in all four breeds, much higher performances were achieved in 2016 when the factors influencing the production and those influencing the incubation were strictly respected.

By respecting the factors that influence reproduction, a larger number of eggs can be obtained, with a high degree of fecundity, and by respecting the influential factors of hatching, the number of ducklings that are obtained is much higher.

In figures, by controlling reproductive and incubation technology, the percentage of hatching increases by approx. 13.40%, and the percentages of clear eggs, respectively of mortality decreases by 14.60% and 21.70%.

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REFERENCES

Applegate T.J., Harper D., Lirbun M.S, 1988. Production age on egg composition and embryo development in comercial pekin duck. Poltry Science, vol. 77, 1608-1612.

Dinea Mariana, 2008. Creșterea păsărilor. Ed. Risoprint.

El-Hanoun A.M., Rizk R.E.E., Shaihein H.A., Hassan N.S., Brake J., 2012. Effects on incubation humidity and flock age an hatchability traits and posthach growth in Pekin ducks. Poultry Science, vol 91, 2391-2397.

Harum M.A.S., Veneeklaas R.J., Visser G.H., Van Kampen M., 2001. Artificial incubation of Muscovy duck eggs, why some eggs hatch and others do not. Poultry Science, vol 80, 219-224.

Popescu-Micloșanu Elena, 2007. Birds Creșterea păsărilor pentru producția de ouă. Ed. Printech.

Popescu-Micloșanu Elena, 2004. Creșterea rațelor și a gâștelor. Ed. RENTROP AND STRATON. Bucharest

Tipuriță D., 1986. Ed. Ceres, Bucharest.

***http://www.intratechengineers.com