HATCHABILITY PREDICTION IN ROSS-308 CROSS-BRED BROILER CHICKENS

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Abstract. The aim of this study was to develop a method for the prediction of broiler chicken hatchability on the basis of the biological control of eggs. The incubation of Ross-308 cross-bred eggs was carried out during the period from 2011 to 2016. A formula for predicting broiler chicken hatchability for the current program of maintenance of the parent stock and egg incubation mode was obtained using the results of egg incubation analysis. The difference between the observed and expected hatching rates fluctuated within a range of -0.1 to +1.3 %. The hatchability prediction of broiler chickens according to the proposed formula based on the results of biocontrol for 0-11 days is accurate enough to be recommended for use at enterprises producing and selling day-old Ross-308 cross-bred meat broiler chickens.

Keywords: incubation, biological control, embryo mortality, laid egg hatchability, prediction formula.

Introduction

Incubation indicators provide an objective assessment of the reproductive qualities of birds. Normally, the range of chicken egg hatchability is 86-92 %, and young chick hatch is 80-87 %, respectively. A high hatchability rate for cross-bred meat chickens is observed over a wide range of egg weights, Haugh Units, albumen-yolk correlation ratio, and across a narrow range in terms of shape index, egg density and eggshell thickness.

Based on the achievements of breeding work, poultry breeding improvement and technical progress, constant corrective amendments have been introduced into egg incubation techniques and parameters that provide the genetic determination of a standardised hatch of baby chicks.

The embryonic viability of modern highly efficient chicken crosses is higher compared with the previously used breeding material. In terms of incubation time, laying crosses can, for our purposes, be referred to as "stayers" and meat crosses – as "sprinters". On the basis of the widespread proliferation of endo- and exotoxicosis, an increase in the proportion of secondary vitamin deficiencies, arrested development and deformity of embryos can be diagnosed.

In the incubation of meat chicken cross eggs it became an established practice to reduce the air temperature to 36.6-36.8 ºC (97.9-98.2 ºF) following mass pipping and to adjust incubation mode control in agreement with eggshell or embryos temperature. Circadian incubation, Dynamic Weight Loss System and Synchro-Hatch were introduced into the incubation technology in accordance with pipping intensity.

In this connection, hatchery managers must accurately predict chick hatch rates depending on the biological value of eggs and technical capabilities of hatcheries. Unlike the various indexes referred to in edible egg and chicken meat production, there are no such indexes in egg incubation [1].

In this relation, a certain role can be played by lifecycle biological control of egg incubation [2; 3].

Materials and methods

The aim of our study was to develop a method for broiler chick hatchability prediction depending on the biological control of eggs.

An incubation of Ross-308 cross-bred chicken eggs was carried out in modern hatcheries "Universal-55", "IUP-F-45", and "IUV-F-15". For the incubation, parent stock eggs produced in the South of Russia ("Baksan Broiler Agrogrup" in the Kabardino-Balkar Republic, "Pervomayskaya IPS Llc" and "Rus SVS Llc in Krasnodarsky kray) were used. The incubation mode conformed to the ARRITPI RAS recommendations [4]. Prior to setting for incubation, the eggs were moistened by 0.2 % solution of "Bactericide". A total egg ovoscoping (candling) in control trays was carried out on day 12 of incubation; following chick sampling, the egg residue opening was made.

Results and discussion

At the first stage, 22 egg sets in a volume of 3,860.6 thousand were analysed. On average, the broiler hatch comprised 79.4 %, exceeding the minimal requirement of the OST10 321-2003 industry standard [5] of 78.0 %.

According to biological control data for days 0-11 (HW), the sets were divided into five groups with 2 % intervals, with young hatch mean defined for each group (Table 1).

Table 1

Ross-308 cross-bred meat chicken incubation results in relation to hatchery waste volume for days 0-11

Num. of sets	Number of eggs set, pieces	Hatchery waste, %		Young hatch, %		Difference between hatchery wastes for days 0-21 and 0-11, %	
		range	mean	range	mean	range	mean
I. Hatchery waste on days 0-11: 8.0 % or less							
19	838731	5.4-8.0	6.9	78.0-85.9	82.9	7.7-14.6	10.2
II. Hatchery waste on days 0-11 ranged 8.1-10.0 %							
21	909659	8.1-9.9	8.9	78.4-83.1	81.0	8.5-12.6	10.1
III. Hatchery waste on days 0-11 ranged 10.1-12.0 %							
15	580055	10.1 -11.9	10.8	77.5-81.4	80.3	6.4-11.2	8.9
IV. Hatchery waste on days 0-11 ranged 12.1-14.0 %							
15	594109	12.1-14.0	13.1	76.1-80.8	78.2	5.4-10.8	8.7
V. Hatchery waste on days: 14.1 % or more							
22	938049	14.1-17.9	15.2	74.5-79.0	76.5	3.1-11.3	8.3
Total	3860603	5.4 -17.9	11.0	74.5-85.9	79.4	3.1-14.6	9.6

To the difference between total hatchery wastes (days 0-21) and hatchery wastes (days 0-11) 1 % of "weak and crppled" chicks was added for each group and the hatchery waste prediction coefficient was calculated (Table 2).

Table 2

Relation between hatchery wastes on days 0-11 and hatchery waste prediction coefficient

Indicator	Hatchery waste groups on days 0-11				
	I	II	III	IV	V
Hatchery waste range on days 0-11, %	8.0 or less	8.1-10.0	10.1-12.0	12.1-14.0	14.0 or more
HWPC	11.2	11.1	9.9	9.7	9.3

Thus, a formula for the calculation of a predicted Ross 308 cross-bred chick hatch was obtained:

$$PCCH(\%) = 100 - (HW + HWPC).$$

The procedure for calculation is as follows: 69058 eggs were set for incubation. Based on the results of live egg ovoscoping on the twelfth day of incubation, hatchery waste in control trays (minimum 3 trays per incubation staff or 1 % of a sitting) for days 0-11 (6.8 %) and PCHW of the corresponding category (I. "8.00 % and less") are estimated; then the expected broiler chick hatch is calculated: 82.0 = 100 – (6.8 + 11.2). In case of using eggs stored longer than 6 days, it is advisable to add a minimum of 1 % of embryo mortality for each day [6].

At the second stage, the proposed formula was tested in industrial conditions.

In 2015, with the incubation of 436.4 thousand eggs in 8 batches it was established that for week 27-30 of the parent stock the amount of hatchery waste before day 5 ("infertiles", "dead before 48 hours", "blood rings"), or HW, according to our formula, was on average 1.9 times higher than the total amount of subsequent wastes ("dead-in-shell", "late dead", or "weak and crippled"), and 2.3 times higher for 31-37 week age. The hatch level of viable young birds was higher than that required by the OST 10 321-2003 industry standard [5], but lower than the optimal level for Ross-308

cross-breds by 2.8 %. The difference between the actual and the predicted levels of broiler hatch fluctuated within a range of -0.1 to 1.3 %.

In 2016, a detailed incubation analysis was carried out for 422.3 thousand eggs in 8 batches. Due to the use of eggs from different aged stock (from 27 to 58 weeks) and their varying proportions in batches, the hatchery waste amount was calculated in control trays on day 12 and upon the opening after hatching according to the "weighted arithmetic mean" formula [7]. The predicted broiler hatch was on average 1.3 % higher than the actual one.

On the basis of the tendency analysis in egg incubation, the following recommendations were proposed to improve the meat chicken incubation technology (in Universal-55, IUP-F-45 and IUV-F-15 incubators): to fill egg cooling cabinets not more than 80 % in volume; to place the trays horizontally for 15-20 min. from day 14; to carry out the total candling and remove hatchery waste during the egg transfer from incubator trays to hatching ones.

Conclusions

The broiler chick hatch predictability based on the proposed formula and biological control results for days 0-11 is accurate enough to be recommended for use at enterprises producing and selling day-old Ross-308 cross-bred meat broiler chickens.

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