Middle-East Journal of Scientific Research 22 (10): 1485-1492, 2014
ISSN 1990-9233

DOI: 10.5829/idosi.mejsr.2014.22.10.21479

New Modes of Incubation and Implementation Methodology

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Abstract: A complex research of the most relevant parameters incubation processes, has shown the need for introducing new, or upgrading used modes of operation incubator. With currently established means of monitoring and control are applied only to fixed temperature regimes. This article discusses the new regimes and approaches to their implementation.

Key words: Agriculture · Animal breeding · Incubation · Nonstationarity · Vitality · Termokontrast · Automatic control

INTRODUCTION

One of the most important strategic objectives of the agricultural policy of the State in the economic sphere is the creation of effective competitive agricultural production. Currently, the domestic food market is about 33%, which is a direct threat to the food security of the country. Therefore, the number of priority national projects included development of Agriculture of Russia. Project realization is possible by creating a vertically-integrated complex for the production of animal husbandry products using the latest technologies and closed cycle of production, use of innovative products, better-quality meat production amid high security production and its environmental friendliness to the environment.

While a number of issues in the poultry industry and animal husbandry may be selected or technological means. First of all, this refers to the grounds with low heritability nasleduemosti because of their high dependence on environmental factors. In these cases, to improve the performance of farm animals provided a combination of selection and process techniques [1-21].

MATERIALS AND METHODS

The poultry farming industry has the capacity for rapid and effective replenishment of food resources. One of the most important processes of industrial poultry farming is the incubation. A great contribution to the development of an incubation made key issues domestic and foreign scientists, whose works are analyses below. Much has been done in the scientifically grounded methods of incubation and biological control incubations from eggs by the all-Russian research and technological Institute of poultry farming.

The main incubation Park Russia focuses in incubators and large poultry farms. Specialized poultry farm and hatchery-poultry station many have year-round incubation. Further improvement of the incubators, the increase of the coefficient of their use, improvement of technological process of SA incubation, mechanization and automation of the labor-intensive processes, improvement of quality indicators incubation-essential conditions of the technical progress of industrial poultry farming and instability The main indicators of the efficiency of the process are the hatchability of eggs and survival of young animals. Therefore that one of the actual problems of poultry remains the goal mouth to establish scientifically sound, proven practice of incubators, which refers to a set of physical factors, reducing the normal development of the embryo and the high level of the indicator.

One of the ways to improve the efficiency of poultry egg incubation is the further improvement of the incubation process, which has not fully exhausted. The reason for this claim are the results of the comparison conditions and the effectiveness of the natural and the

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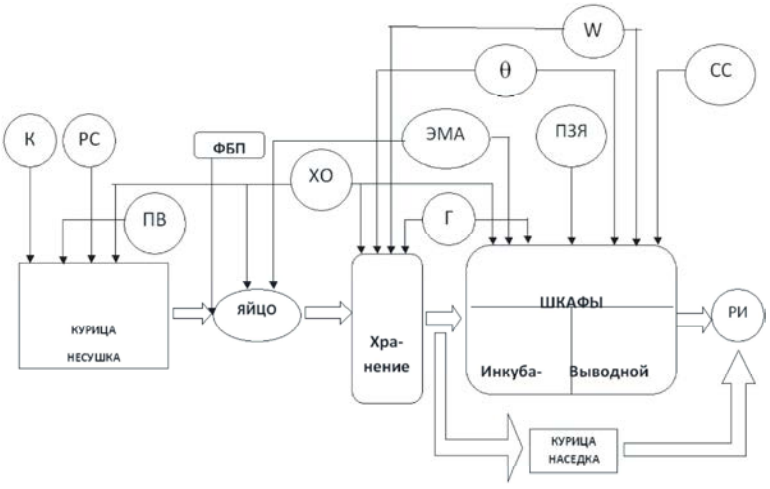

Fig 1: Panel parameters and factors performance indicators incubation

artificial incubation. So, when the artificial incubation, which is characterized by a stable temperature regime, standardized, for example, hatchability of chicken eggs is 75-80%. In fact, it is often located on a lower level. At the same time, the natural incubation provides nearly 100% hatchability of eggs. What can explain such a significant difference of the two types of incubation?

Among the most important physical factors that characterize the process of incubation was low, since it determines the effect on the intensity of metabolism and speed the development of embryos. The literature data and the results of our research thermal nests bird- clockers, indicate that the temperature of the eggs, incubated under natural conditions, changes in a relatively wide range, because the mother hen turns and roll eggs, leave the nest for food intake and defecation. Study of the effect of temperature on performance of incubators and the subject of the works. In many of these works is the significant difference Non conditions and thermal modes of natural and artificial incubation.

Because in our country each year in incubators are billions of eggs, incomplete their hatchability results in economic as from underproduction and reduction of its the life viability and the excessive consumption of electric power consumed by the incubators. Therefore, further improvement of the structures and modes of operation of these technological devices is an important uçe people's country issue task.

Further work is planned in accordance with the Republican (Federal General) target scientific and technical program "research and development in priority directions of development of scientific-technological complex of Russia in 2014-2020 years". Its results are directed to "develop and implement technological process of SI incubation eggs to increase hatchability on all types of birds at up to 7%, labour productivity in the 1.5 -2 times". Experimental-industrial validation of results of theoretical research and research-based recommendations repeatedly made to the Šhaht and Krasnodar incubation stations [19-21].

RESULTS

As you know, the most responsible process of poultry reproduction is incubation, the effectiveness of which is characterized by withdrawal and the viability of whole animals. We conducted an analysis of literature sources show that the impact of incubation affected more than 30 different parameters and factors. [3-8, 11-15]. It can join us in several provisions of the following groups, shown in Figure 1. 1: breed and age of laying hens (BA), feeding regimes (K, PC), physico-chemical and biological parameters of hatching eggs (PBP), storage conditions and the last processing (LPI), electromagnetic and acoustic effects on eggs (EMA), composition and parameters of the gas environment during storage and incubation of eggs (G), the sanitary condition of the equipment and the sanitary conditions of incubation (SK), position the vent flaps and eggs in trays under incubation (PVF) and, finally, conditions and modes of the incubation, which is determined by, first of all, the three main parameters-temperature incubation and lead the cabinets (Q), its relative humidity (W) and air exchange. In assessing the impact on the result of incubation (RI) of individual parameters and factors must, of course, take into account not only the level of each of them, but also

their combination and interaction. It is generally acknowledged that among the factors decisive influence on hatchability of eggs and the viability of the chicks has a real mode of incubation temperature. The study of this effect and featured modes are shown in numerous publications. However, the hatchability of chicken eggs in the stable temperature conditions is only at 85%. At the same time when hatching chicks hen when postinkubacion period there is a high resistance of young animals to various diseases Therefore, one of the possible directions of improving effective efficiency of artificial incubation is a detailed study of the thermal regime of eggs in a nest chicken-Clockers (ideal) and playing it in artificial conditions. This approach is consistent with the basic principle of bionics-learning from nature, which for millennia had brought many biological processes to perfection. The study of eggs under conditions of natural regime is dedicated to a number of works, the results of which are summarised in a training and reference literature [1, 2, 11-15]. Successfully worked in t his area scholars such as N...N. Hincinskij, P.A. Mantejfel, V.V. Rolnik, V.V. Ferdinandov and N.P. Tretyakov. The authors of these works in 30 years conducted a study of the thermal state of eggs in the nest of snoopers and made recommendations, which were used to create local incubators and optimize their thermal modes. The main findings of the research studies of thermal conditions of natural incubation are set out below. Eggs in the nest are heated only top contact method Clockers, which has a relatively constant temperature, jealous 40.42° C. Chicken many times during the day (up to 50 times) flips eggs, bool them from the Center to the periphery and slot back, leave the nest for a meal, that is inkubate the eggs to the natural regime constantly subjected to thermal perturbation. Remains constant and the temperature in the nest. She is always below the temperature of the chicken-Clockers and not greater than the temperature of the eggs. The heated air in the nest-no heat source and the environment, absorbing excess physiological heat eggs. This means that the natural process of heat transfer conditions is well away from the egg to the litter and air environment. At the end of the incubation, the mother hen less densely nestles on eggs and leave the nest. Thus, egg incubation, as in the nest (as opposed to the incubation of Cabinet) complex thermal condition and temperature of the embryo is constantly changing. In the process of evolution of the egg with a developing embryo in it have adapted to such changes in key temperature conditions. The need for embryos in variable temperatures-is the biologic feature characteristic forms, the evolution of which took place in the specified temperature conditions. incubate eggs are subjected to repeated thermal shocks, hatchability is close to 100%.

Temperature fluctuations eggs not only had a negative impact on the development of the embryo, but also contribute to the high withdrawal rate. Such fluctuations harden the body of the embryo and create rable conditions for the Exchange processes, providing greater failure of the chick in the postembrional period. By cooling the contents of eggs shrinks more than shell. Through her pores in the egg is sucked air, i.e. enhanced gas exchange of the embryo, the more intense his breathing and metabolism. The positive influence of the temperature on the variables incubate eggs celebrated by many researchers. So, E.F. Lissitzky believes that the change in temperature within 37... 40° C, in a small period of time stimulates the growth of the embryo, as the thermal stimulus D. Nidgem specifies that temperature increase produces narrowing vessel effect the embryo and reduces blood flow, thus preventing the entry of more food than it can reasonably use. Decrease in temperature causes the reverse process: vessels dilate and increase blood flow, increased supply of necessary substances for continuous development. P.A. Mantejfel noted that "temperature jump increases the intensity of growth and strengthens the body."

Due to temperature fluctuations, enhanced oxidation processes in the embryon and toniziruetsâ the nervous system. In the last days of incubation at lower ambient temperature no longer reacts in the germ of its temperature, increased metabolism, more intensive use of nutrient reserves of eggs and high teploobrazovaniem. comparison of thermal modes of natural and artificial incubation clearly see the difference. The first of these modes can be described as a termokontrast and the second is how heat stable. The absence of artificial incubation of variables (temperature effects on the developing fetus leads to the loss of all of the above positive effects that increase hatchability eggs and chicks when they are hatching viability at this fact noted by several researchers in industrial hatcheries mode variable temperatures and receiving good results. N..E. Lysenko suggested cooling the eggs in the early incubation 2 times a day, increasing the hatchability at 5.2% which compared with uncooled hatchability eggs. Experiments conducted By N.P.Tretyakov and S.O. Peltzer on the Bratcevskaya poultry farm have confirmed high efficiency of incubating chicken eggs at variable temperatures. Also presented the results of the research of a new method of TAT hatching of poultry with temperature variations since

the early days of incubation. This method compared to standard increased hatchability young on 3... 5% significant improvement of its quality. The essence of the proposed method was that 2 times a day (morning and evening) in the closet, narrowed incubation eggs, input the cool air, lowering the temperature inside the Cabinet to 33° C. During the cooling of furnaces and humidifiers would be disconnected. Length of cooling accounted for 10-15 minutes. When it reaches the specified temperature flow of cooler air in the incubator stopped and shut down heaters. Air temperature recovery time of up to 37.5° c was 30 min. To improve hatchability and survival of chicks of egg chickens also previously offered with 13 days of incubation once per day to cool the eggs up to 29... 30°C on the surface by blowing a stream of air at the incubator of online/offline users heaters. Analysis of 16 different temperature regimes showed that the best (it provides increased hatchability at 2... 5%) is the following: the first 3.5 days in the incubator "Touring" is supported by a stable temperature 38.3° C and later to the times a day is a short cooling incubated eggs.

Thus, many researchers-P.a. Mantejfel' (1934) and m. Wilner (1935), N.p. Tretyakov (1937-1964), V.v. Ferdinands, V.V. Rolnik (1944), G. Maštaller (1943-1948), T. Zaletaeva (1954), A.u. Bykhovets (1960), C.H. Ruus (1963), S.O. Peltzer (1954), by M. Khojaev (1964), A.M. Šanskova (1965) and the other, the scientists who carried out the experiments under conditions of natural incubation, noted the beneficial effect of temperature on the embryonic development of variables [3-6, 11-15] Learn ing, such work is recommended for artificial incubation and more on the use of variable-temperature modethat gives a higher quantity and quality than "stable". In 1965, also were incubated eggs of ducks, which showed that their periodic cooling while and delay the growth of the embryo, but create a more favourable environment for embryo development.. Û.Z. Windrow also presented the results of a study on the development of embryos of chickens temperature fluctuations, which were provided by systematically lowering and raising the air temperature in the incubator. Cooling was used to cool air 2 times a day from 37.5 to 30...34° c with a duration of 30-35 min. Hatchability of eggs at this amounted to 92.94% and topped that figure in the control cabinet for 1.5... 3.4%. Thus, temperature fluctuations, compared with stable thermal couple delayed growth of the embryo, but promote better assimilation of nutrients from eggs and calcium from the shell, which shell eggs, incubated for at variable temperature, contains calcium approximately 0.8% lower and the embryo at 0.12 percent. V.V. Ferdinandov, variable temperature regime of eggs of waterfowl by use of hold from the early days of incubation, improves the output of young animals while at the same time improving the quality result. However, for the incubation of the eggs is still insufficiently developed and, to a lesser extent, applied in daily practice. Development of bird embryos takes place outside the mother's body and is entirely dependent on the temperature conditions of the environment. Study of the influence of periodic colding on the development of chick embryos during the first few days of incubation was carried out in an incubator "universal" on the Central hatchery-poultry station. Following incubation mode supported: low 37.5...37.7° C, relative humidity 47- 50% and rotate the trays was carried out after every 2:0. Since the end of the first day on the 19th inclusive, eggs, cooled as the experimental group and two times a day at regular intervals (at 8 and 20:00). In all the experiments for cooling off the heater, open the cabinet door, left on ventilation and humidification system. One by one the following three exposures were cold eggs: on first exposure temperature inside the egg eating before 30... 29° c for 45 minutes and restored her to normal for 1:30-1:40; the second exposition of cooling was 32° c for 30 minutes and restore to normal temperatures lasted 1:0-1:10; the third exposure for 12... 15 minutes vnutriâjcevuû the temperature reduced to 34° c and rebuilt it within minutes. In this exposition as fast recovery temperature was achieved by the inclusion of additional heaters, pilot studies, temperatures in the hatchery was within 17... 20° c. The minimum values of the temperature are presented in table the best exposition of colding was the third, when within a relatively short time is reached the temperature of 34 inside and 32° c on the surface of the egg.

Table

		Temperature,° C		
Exposition	Cooling duration, min	tair around the eggs	surface of the egg	inside the egg
1	35...45	30,0	30,0	30,2
2	25...30	30,0	31,6	32,0
3	10...12	30,6	31,8	34,5

Thus, the generalisation of the results of the use of variable-temperature regime, executed by different researchers:

- The periodic cooling of the incubated eggs keep fat metabolism of embryos at a certain level, avoiding the excessive intensification;
- Cooling, promoting the development of the circulatory system, grows its oxidative capacity, resulting in an increase in hemoglobin and red blood cells in the blood; These Adaptive changes to make it easier to "experience" the embryo period respiratory problems associated with the accumulation of blood by 2 fat metabolism and to the moment of transition from breathing to pulmonary allantois breathing in pulmonary:
- Temperature fluctuations within the good development of embryos, in terms of growth rate, the full utilization of protein and nutrients; ambrion mortality decreases and the output and quality of young grows.

Despite the fact that the researchers corrected the standard thermal conditions of artificial incubation and increased his termokontrastnost'û, he stood still is far from the regime existing in a nest chicken-Clockers. In addition, the implementation of the adjustment requires, as a rule, large capital outlays on modernization of incubators.

Conducted a review of the literature showed that often the main tool for the study of thermal modes of incubation is a liquid expansion thermometer, which, with its high precision, allows remote measurement and registration of temperatures, as well as measure the surface and inside the eggs. This thermometer is inconvenient, of course, in the long-term and continuous control of the heat as stock of incubation and, especially, in the bird's nest-Clockers.

For remote measurement of surface temperature vnutriâjcevoj and artificial and natural incubation of some researchers used in thermocouples, which include thermoelectric converter (thermocouple) and shows (a galvanometer or PF Millivolt meter). However, the introduction of thermocouples in the egg breaks the vital activity of the embryo, as they do not provide reliable sterility, poisoning inside the egg stuff products of oxidation of metals, are part of thermocouple and leads eventually to the pathological development of the embryo. When using thermoelectric heat meters must be taken into account and another drawback: when a depth transducer in the egg of termoelectrode is its heat exchange with the environment that in certain conditions can significantly distort the measurement of temperature.

For information about how to use to control the temperature of the surface of the incubated eggs contactless measuring instruments (radiation pyrometers) are in certain activities [10, 11, 13, 14]. In recent years and others, intended for studies of temperature-humidity incubation regimes with a view to improving the effectiveness of their work. However, most of the controls discussed above does not meet modern metrological requirements and does not take into account the full specifics of the controlled object, especially under conditions of natural incubation.

For analytical examination of thermal modes incubated eggs and the summary of the results of the study should have data on the Thermophysical and teploinercionnyh properties of incubation, as well as the conditions of heat exchange with the environment in the egg incubation and nest chicken-Clockers. In the required volume of such information in the literature. For their definition and clarification it is necessary to create the appropriate equipment and to conduct complex investigations.

The thermal properties of influencing the process of heating and cooling a solid homogeneous substances, as is well known, is the density, heat capacity, thermal conductivity л and the peraturoprovodnost? Q and fluid and its viscosity. If the analyzed body of heterogeneous (composite), then you must be aware of all these properties of each component and their mixtures. With respect to the incubation of yolk, protein and the shell of the egg and the egg. Values of r, C, л Q, together with the information on the form and the mode of the body allow to calculate the heating of heat transmitted by thermal conductivity and viscosity of poses allowed to judge the possible heat transfer free convective the heated volume of the fluid.

As noted earlier, data on poultry breeders from thermophysical characteristics of eggs are few and far between. The analysis of the literature on TSS and incubation pticevods confirmed this and showed that the c, л and Q are fragmented and do not give a full picture of the thermophysical properties of the incubation. [3-7, 10-12]. The more relevant research to define and clarify the warmth of the physical characteristics of the incubated eggs, as well as for the study of heat transfer in non-stationary conditions.

Adequately in literature are only the results of determining the density of eggs and their components. They show that the density of yolk protein and eggs, as well as their mixtures are close to each other and lie within a 1030... 1090 kg/m^3. The Cova density and content of eggs with embryos at 11 and 13 days of its development. Shell has a significantly higher density, which is indicated for a substance, is almost entirely made up of calcium carbonate can be accepted equal 2260 kg / m^3. Other Thermophysical properties of the Twa and its individual components need to be defined and clarified.

Thus, the literature reviewed above incubating chicken eggs demonstrates that the mechanism of the thermal interaction with the app bodies and the environment by natural and artificial incubation is different. One of the ways to improve the efficiency of poultry egg incubation is the further improvement of the incubation process, which has not fully exhausted. The reason for this claim are the results of the comparison conditions and the effectiveness of the natural and the artificial incubation. So, when the artificial incubation, which is characterized by a stable temperature regime, standardized, for example, hatchability of chicken eggs is 75-80%. In fact, it is often located on a lower level. At the same time, the natural incubation provides nearly 100% hatchability of eggs. What can explain such a significant difference of the two types of incubation? The literature data of thermal regime on birds nests-brooding hens showed that the temperature of the eggs incubated under natural conditions, changes in a relatively wide range, because the mother hen turns and roll eggs, leave the nest for food intake and defecation. Therefore, the temperature of the natural as opposed to artificial incubation is very termokontrast [3-6, 10-14].

So, when the natural warmth to the egg incubation is from body heat conduction and is given to brooding hens into the environment through a porous pad socket thermal conductivity and convection and with the open part of the egg – free convection airflow, radiation and moisture evaporating from the surface. In heating and cooling of eggs is forced to flow air fed fan, as well as radiant heat exchange between the eggs and the incubation cabinet design. MI Calculation of thermal state of transient incubation eggs requires prior determination of magnitudes characterizing conditions of heat exchange with the environment. The heat due to evaporation is most convenient to surface runoff and heat distributed throughout the area of the outer surface of the egg. His power will be equals to the product of the amount of moisture evaporated on its specific heat of vaporization. Data for the calculation are given in the reference literature defining the radiation component of heat exchange also is straightforward.

However, the originality of the geometrical characteristics of the various objects allows you to apply for the calculation of heating (cooling) of the ratio given in the Lite raturnyh sources. Some results obtained by researchers should be clarified, for example, ostrich, quail, pigeon and incubation facilities previously proposed methodology can also be applied to objects.

CONCLUSION

Thus, the literature review conducted analysis and compare the relative evaluation of thermal conditions of incubation, as well as their means of control and monitoring of data on thermal properties of the incubated eggs demonstrated the necessity and the possibility of further improving the process of incubation. Confirmed the feasibility of hypothesis in incubators, close to the thermal conditions of the nest snoopers.

To improve the efficiency of artificial incubation by developing and implementing a new termokontrast regime, simulating thermal impact, which causes the incubate eggs snoopers, requires addressing a number of interrelated scientific and practical problems. Namely, it is necessary to introduce a new way of implementing non-stationary regimes of complex analytical and technological and experimental research related to the definition of [15-18]:

- Thermophysical properties of biological objects;
- Conditions and parameters of mechanical stress, heat and humidity Exchange with the environment in vivo hatchability and biological objects;
- Teploinercion properties of biological objects, both physical bodies subjected to external perturbation.

To perform these studies should, in turn, developed a relevant methodology, as well as a special the metering and research equipment. This equipment is required for both the study of transient temperature incubators for milking the termokontrast conditions in incubators and for pilot testing and implementation in modern incubators new proposed ways of incubating chicken eggs.

CONCLUSION

In conclusion, it should be noted that for new incubation processes efficiency of introduction of batch-mode termokontrast is confirmed at poultry farms in the Rostov region. The results of multiple studies of chick incubation facilities have significantly improved their hatchability and survival of young animals, as well as reduce the complexity of the design and implementation of automatic control systems of heat treatment. Thus, to test the viability of calves derived from control plats and experienced parties over 8 days observed. Testing Nonstationary regime incubation showed 86-90% hatchability of chicken eggs and the vitality of the young birds (almost 100%, as the natural modes of hatching), which confirmed the effectiveness of termokontrast of incubation processes [19-21] and allows you to recommend proposed modes and their implementation methodology as for other species of birds.

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