

Incubation for the Modern Broiler

Michael J. Wineland
NC State University
e-mail: mike_wineland@ncsu.edu

Incubation practices have not changed much over the last 10 years although genetics have handed us a different embryo to work with. Genetic improvements of the modern broiler has been directed toward increased breast muscling and faster growth rates. This has resulted in alteration of the growth and physiology of the embryo and thus different responses to the incubator parameters that had become common practice. A number of criteria must be considered. First, understand how the embryo and chick respond to different incubation parameters. Second, one must evaluate their setters and hatchers. Insure that they are operating correctly. Third, evaluate the incubation parameters that are being used. This becomes a challenge if you operate multistage setters

Responses of the developing embryo:

The embryo needs to develop in a prescribed sequence and the organ systems must have adequate time to mature and be ready for the challenges outside the egg. Probably, single stage incubation would be the preferred method to better meet the needs of the embryos because incubation parameters are directed to a specific age of embryo. However the capital cost of switching to single stage may be prohibitive for many, even knowing the potential payback through improved performance. Possibly, an improved understanding of where (at what stages of incubation) the embryo is sensitive to the various parameters of incubation will help us to better adjust the practices of multistage incubation.

There is some evidence that the modern higher yielding broiler is metabolically different. There is increased heat production by as much as 44% as shown by Hulet 2000. This increased heat production can become a problem not only for the older embryo producing it, but also for the younger embryos in the machine if the excess metabolic heat is not properly removed. Failure to remove the excess metabolic heat can cause metabolic and physiological changes (cardiac and intestinal) in the broiler (Wineland & Christensen, 2000), the turkey (French 2000) and in subsequent broiler performance (Hulet, 2000). Sufficient early temperature, yet not excessive is critical, there is some preliminary information

that demonstrates the importance of slightly elevated temperatures during the initial days of incubation. (Christensen et al., 2002). The initiation of growth at the start of incubation is going to be mainly influenced by temperature. How important is this to the time of hatch and the narrowness of the hatching window to the success of high quality chicks?

Obviously, temperature is not the only incubation parameter. Ventilation is important as well as humidity. Humidity not only will alter time of hatch but also the physiology of the developing embryo that may impact performance. Eggs from a flock will naturally lose water vapor from the egg over a large range. The average water vapor loss then is additionally modified by the relative humidity that the setters and hatchers are set at as well as the hatchery room conditions with regard to RH. Moisture loss in eggs has been shown to alter the embryo. The most severely affected embryos are those that lose less than the average amount of moisture from a flock's eggs (Wineland et al. 2002).

The oxygen and carbon dioxide concentrations have also been demonstrated to alter the embryo, although to a lesser extent if everything else is correct. The need to have a mature digestive tract is essential for the new-hatched chick. There is evidence that the parameters of incubation can alter it appreciably.

Important to evaluate setters and hatchers:

The embryo from the current breed crosses has made it apparent, how inadequate the environments within the setter and hatcher can be. Temperatures are extremely variable if machines are not operated correctly and because of some designs. How the hatchery rooms are operated can affect the temperature and ventilation for the embryo.

Do you regularly check the incubators to make sure that the sensors are correctly calibrated, and that the rooms are properly adjusted for temperature, humidity and ventilation? Using a good reference thermometer is essential to having the machines operating properly. How the rooms of the hatchery are regulated with regards to temperature, humidity and ventilation is very important. The hatchery rooms each act as a compartment that influence operation of the incubator. The hatchery rooms must be regulated such that the incubators only have to fine tune the environment for the embryos.

Proper airflow within and through the setters and hatchers is essential. Not only do they insure adequate oxygen for the embryos but also it are also important in the dissipation of excess metabolic heat. We need to know first whether the machines are inadequately removing excess heat and if so, then minimizing its influence. Making alterations by adjustment in temperatures in the setter, and in the hatcher are a good start.

Altering the incubation environment:

The accumulating information would lead us to believe that the embryo from the high yield embryo must be incubated differently, possibly in different types of machines or with different management systems using the current multistage. Single stage machines should certainly address the needs of all embryos within a given machine. The economic picture of a company may not allow for that at this time. So are other options available? Obviously this will be severely impacted by whether you have Jamesway or Chickmaster. Have you seen to it that the setter and hatcher rooms are optimal to minimize the amount of heat and humidity the machines must add? The lowering of the hatcher temperatures may help to provide more beneficial embryo and chick temperatures. Possibly, altering the time of transfer so that heat loss toward the end of incubation can be improved may help. Have you seen to it that the effects of poor air exchange are not detrimental to the embryo? Is the humidity adequate, not only to remove the metabolic water that appears necessary for proper development but also realizing that it may play an important part in heat removal from the egg?

Evaluating chick quality is difficult and requires constant evaluation using all indicators and techniques possible. But, of equal importance is the environment and care the chicks are subjected to in the broiler house.