Analysing embryo mortality 108

www.pasreform.com

by Maciej Kolanczyk, Senior Hatchery Advisor
Royal Pas Reform Integrated Hatchery Solutions

Only fertile eggs result in chicks. However, the hatchery manager has no direct influence on egg fertility, and can only utilise the potential created on a breeder farm. This potential, which can be utilised to a greater or lesser extent, is expressed technically as Hatch of Fertile (HOF).

As the identification of infertile eggs by candling is not very precise and removed 'clears' may also include eggs with embryos that died in an early stage, the term Hatch of Transfer (HOT) may be more accurate. This expresses the efficiency of the hatchery process and can vary greatly.

A HOT between 90-96% is considered good, as long as the very early mortality is low. For a high HOT of 96%, the remaining 4% embryo mortality would, under normal circumstances, be roughly divided 50:50 over the first and last week of incubation.

These proportions can change dramatically if the HOT is lower. The break-out of unhatched eggs (including clears) gives information about the phase in which embryos die. This allows conclusions to be drawn about possible reasons for the mortality and any possible corrections that might be needed. The first question, therefore, is: Did the embryos die in an early or late phase?

Early mortality

Before the blood ring phase, early mortality is mostly related to the status of a breeder flock (nutrition, diseases), egg handling (collection, cooling, unstable temperature, rough transport) and mistakes in hatchery procedures (traying, storage, disinfection, preheating, starting incubation programme).

The first task when analysing clears is to separate the true infertile eggs from eggs in which the embryos died in an early stage. The fate of embryos in the first week of incubation is mainly determined by temperature issues, such as a suboptimal temperature or rate of temperature increase or a non-uniform temperature distribution, leading locally to extreme values inside the machine. Humidity and air supply play a limited role in this phase

Late embryo mortality

Late embryo mortality is much more complex. The fact that embryos reach an advanced phase is promising and improves their prospects. Embryos die late due to exhaustion as a result of prolonged overheating in the exothermic phase (after day 10-12), or due to insufficient development resulting from a permanently low temperature. Another reason can be insufficient or non-uniform ventilation during the final days of incubation.

Large temperature differences within a setter may be caused by excessive humidifier, cooler and heater activity. This can happen if the programmed set points are technically difficult to reach for the incubator, or as a result of incorrect physical air supply parameters, imbalanced supply and exhaust pressures or inefficient internal air mixing.

The phase of gut absorption (days 16-19) and yolk sac absorption (day 20) helps to identify the moment that the embryo died. The cause of the mortality, however, usually occurs much earlier. For example, fully developed embryos can 'drown' in the shell at the internal pipping phase due to insufficient egg weight loss during incubation. All embryos in the hatcher are in their late phase, and therefore highly sensitive to overheating and a shortage of oxygen. Hatching takes several hours and requires a balance between good ventilation and a comfortable environment, both for the hatched and the as-yet unhatched chicks.

Advice

- Identify true infertile eggs and exclude them from embryo mortality analysis.
- Group dead embryos by age to identify mortality peaks.
- Draw conclusions regarding possible causes.
- Consider egg shell temperatures and egg weight loss before correcting the incubation programme.

Tel: +31 314 659 111 • academy@pasreform.com

First published in International Hatchery Practice 36.2

Limit your program library

109

www.pasreform.com

by Maciej Kolanczyk,
Senior Hatchery Specialist, Royal Pas Reform

A contemporary hatchery is usually a big installation with many setters that are controlled by a specialised computer. This computer can have numerous functions. For example, it can store data on activities related to the entire hatchery operation, such as climate, service, maintenance and turnover of eggs and chicks, and it can monitor the functioning of all the installed equipment, failures and alarms. An important part of the computer is the program library, which contains a set of incubation programs.

The basic incubation programs supplied by the incubator manufacturer provide a safe framework to start with. Note that – however successful it is – an incubation program from a neighbour using the same brand of incubators cannot be simply transferred and applied.

The incubation program must be designed based on the specific, local conditions, such as the brand and type of machines, details of their installation (piping, air supply system), climate (winter/summer, rainy/dry), altitude, duration and conditions of egg storage, breed and age of the flock, egg size, and even a flock's health status.

All of these factors may require different programs. So, although the potential offered by computers is highly appealing – a new version of an incubation program can be prepared quickly and the program library can contain an unlimited list of programs for all possible situations – this list needs to be kept within certain limits.

A big hatchery usually operates based on what it receives from the large egg suppliers. The average breeder farm size has increased substantially over the years, and in some cases a single flock can count as many as 100,000 hens or more.

As a consequence, hatcheries may receive large, uniform batches of eggs for entire setters. Moreover, modern technology allows the mechanical grading of eggs that are produced by the same flock, which can also increase the uniformity of the load. Large, uniform batches of eggs collected within a short time create an ideal situation for applying batch-specific incubation programs. This is in contrast to the situation in which setters loaded with a mix of eggs of different characteristics require an incubation program that benefits the average egg.

Furthermore, by controlling the internal climate and air supply parameters, the hatchery is less dependent on the seasons and prevailing weather conditions. Under normal conditions, therefore, a limited number of program variants is required. Even if an incubation program has been proven to lead to excellent results, it cannot be considered as a final, fixed version. New, corrected variants will need to be created, but it makes sense to store the old versions until the new one has proved itself. This process gradually extends the program library.

In the day-to-day operation of a large hatchery, eggs of different types will be loaded to different machines. Using the various incubation programs requires good administration to ensure that the right program is consistently used for the right type of eggs. However, this is not always easy in a hatchery with many setters: as is often seen in the contemporary poultry business.

Advice:

- Develop a basic, standard incubation program for your hatchery for the average situation, egg type and local technical conditions. Use this program for all 'normal' settings.
- Monitor eggshell temperature and egg weight loss so that corrections can be made.
- Prepare a few variants for specific situations such as long storage, old and young flocks, and different seasons, if they have a big impact on the climate conditions.
- Give the programs clear names for easy identification of their purpose and creation date.
- Limit the number of programs being used.

Tel: +31 314 659 111 • academy@pasreform.com

First published in International Hatchery Practice 36.3

Why the difference in results? 110

www.pasreform.com

by Maciej Kolanczyk,
Senior Hatchery Specialist, Royal Pas Reform

Eggs from the same source delivered to different hatcheries will often give different results, even though their biological quality was identical and they were collected from the same flock with the same nutrition and health status during the same period, day after day. Nevertheless, the results can differ substantially and consistently.

Assuming that the fertility level in batches delivered to different hatcheries was the same, the difference in hatchery results can only be explained by differences in embryo mortality. Embryo mortality during incubation follows a certain pattern: most embryos die during the first or last few days and mortality is low for the remaining days. For a high hatch of fertile (HOF) of 95%, about 2% would be lost in the first three to four and last three to four days of incubation, while fewer than 1% would die in the period in between.

There are many factors that can affect the results from different hatcheries. These include egg transportation, storage, disinfection, type and technical status of installed equipment, local climate, altitude, incubation programme, applied procedures, knowledge and experience of staff, and a lot more.

Comparing hatchery results from different hatcheries, we usually notice a difference in the Hatch of Eggs Set (HOS) first. A detailed analysis of differences, even for identical HOS, allows the identification of possible mistakes and ways to remedy these.

Where do we see the differences?

- **Difference in % fertility?**

Eggs from the same flock collected during the same period should have the same true fertility. A difference can only be explained by a difference in early embryonic mortality and the classification of early dying eggs as 'clears'. Opening at least samples of clears selected at an early phase, or even of eggs not yet incubated, can help to determine the most likely cause of an increased early embryo mortality. Was the transport too warm or too rough, or was there improper, prolonged egg storage under unstable conditions? Check the disinfection system: when, how and how often are the eggs disinfected and what kind of disinfectant is used?

- **Mortality during first few days of incubation?**

Beside the factors mentioned above, the most likely incubation-related reason for early embryo mortality is an incorrect temperature. This can be related to the incubation programme, a poor technical status of incubators leading to a non-uniform environment inside the setter, or a too rapid or too slow increase in temperature. It may also be related to disinfectant remaining on the eggs or a turning failure.

- **Differences seen at transfer?**

Transfer, usually combined with candling, provides an overview of embryo mortality at different phases of development. The distribution of losses in different hatcheries can be compared. An increased number of bangers reveals a difference in hygiene level and suggests egg 'sweating'.

- **Hatching and chicks?**

The final hatch result shows the quality of the incubation programme and the hatchery procedures. Dead embryos not identified by conventional candling will be found at hatch. The number of unhatched eggs found in the baskets, the phase when the embryos stopped developing (internal/external pipping or earlier) and the status of eggshells (dryness, cleanness, height of pipping) help to identify weaknesses in the process. The first factors to review are the eggshell temperature after day 12 and the egg weight loss. The chicks themselves, their quality and condition at hatch, the frequency and type of disorders, and mortality in the first week of life can also differ substantially between hatcheries, even if the chicks were produced from the 'same' eggs.

Advice:

- When comparing results, look further than global hatchability numbers.
- Consider the details: search for the type of difference and its timing.
- Use this information to upgrade your programmes and procedures.

Tel: +31 314 659 111 • academy@pasreform.com

First published in International Hatchery Practice 36.4