HatchTech
INCUBATION TECHNOLOGY

Technical Information

How to Survive Prolonged Egg Storage?

Dr. Inge van Roovert-Reijrink M.Sc.

Storage of hatching eggs longer than 7 days causes a delay in hatch time and a decline in hatchability and chick quality. Hatchability declines with approximately 1% per day after 7 days of storage. The cause of this decline in hatchability and chick quality is not clear. During storage changes occur in the embryo. One of the changes is that cells in the embryo die. This can have a negative effect on embryo viability and consequently increases embryonic death.

Cell death can be caused by the length of storage, due to aging of the "sleeping" embryo. But it can also be caused by changes in the egg components. During storage the albumen pH increases from 7.6 to 9.0, and albumen height and the strength of the yolk membrane decline. This might be necessary to protect the embryo against microorganisms and to improve the diffusion of gasses like carbon dioxide and oxygen. On the other hand, an albumen pH of 9 might also cause cell death when the embryo is exposed to it for longer times. When cell death is responsible for the negative effect of prolonged storage, we must prevent or compensate for it to maintain hatchability and chick quality.

Prevention of cell death

Research showed that storage temperature influences cell death in the embryo. When storage temperature decreases, cell death decreases as well. Cell death might be reduced, because the cells survive better when the temperature is reduced. But it is also possible that a reduced storage temperature reduces the diffusion of gases like carbon dioxide through the eggshell.

Because the rise in albumen pH and the decline of albumen height is related to carbon dioxide loss, a reduction in storage temperature delays the changes in the egg components. A slower rise of albumen pH may shorten the time that the embryo is exposed to a pH of 9 and may reduce cell death and therefore improves the viability of the embryo.

The optimal pH for embryo development during early incubation is reported to be 8.2. Perhaps this is also the optimal pH to maintain embryo viability during egg storage. In that case, a rise in albumen pH to 9 should be avoided. This can be done by lowering the storage temperature, but also by storing the eggs in plastic bags, to avoid loss of carbon dioxide. Research already showed that storing eggs in plastic bags can improve hatchability after prolonged storage.

Compensation of cell death

In nature a hen probably compensates for cell death. A hen lays eggs in a clutch and every time the next egg is laid the previous laid egg is incubated for a short time. During that short time the embryo is able to develop a little bit further and cells will multiply, replacing the death cells. In practice this can be achieved by pre-storage incubation. Although this is expected to be beneficial, reported results are not consistent. The research department of HatchTech Incubation Technology also investigated the effect of pre-storage incubation on hatchability and chick quality after prolonged storage.

Two experiments were done. In experiment 1, eggs from a breeder flock of 28 weeks were stored for 12 days. In experiment 2, eggs from a breeder flock of 61 weeks were stored for 11 days. Before storage, half of the eggs were incubated for 6 hours (experiment 1) or 4.5 hours (experiment 2). The other eggs were stored immediately. The duration of pre-storage incubation was reduced in experiment 2, because in the first experiment hatchability of fertile eggs was reduced from 80.2 to 74.9%.

In the second experiment, hatchability of fertile eggs increased by pre-storage incubation from 80.7 to 85.6%. This shows again that the effect of pre-storage warming can be both beneficial or detrimental, and that small changes in the procedure can already cause big differences.

The different results might be caused by the difference in the stage of embryonic development at egg collection (before pre-storage incubation) between the two experiments. At the moment of lay, embryos can be classified in different stages of development. Normally the developmental stage of the embryos ranges from stage VIII to approximately stage XIII. In general, the average stage of embryonic development at moment of lay is stage X (Figure 1). We assume that for optimal storage, embryo development should be in stage XII, but not further than this stage. The embryos in experiment 1 were further developed at egg collection than in experiment 2. Forty percent of the embryos in experiment 1 were already developed beyond the optimum of stage XII before pre-storage incubation, however in experiment 2 the embryos still needed some development to get to this optimum. This might explain the differences in results.

The success of pre-storage incubation depends on the accuracy of bringing the embryo in the right stage of development to resist prolonged storage. Embryos that are less or further developed than stage XII are probably less resistant for prolonged storage. The success of prestorage incubation therefore depends on the developmental stage of the embryo at egg collection and

the duration of prestorage incubation. To optimize the results of pre-storage incubation, the duration should be adjusted according to the developmental stage of the embryo at egg collection to prevent that embryos develop too far. Because the developmental stage of the embryo varies in the field, pre-storage incubation is difficult to use in practice!

In conclusion, pre-storage incubation should be used with care. Accurate compensation for cell death is difficult, we should therefore focus on the prevention of cell death to reduce the negative effect of prolonged storage. Storage temperature is an important tool to prevent cell death and to maintain hatchability and chick quality after prolonged storage!

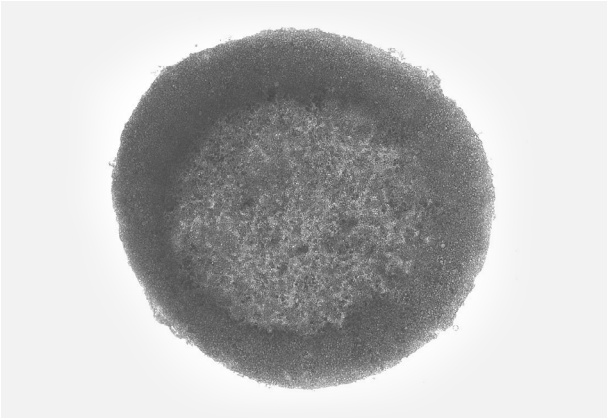

Figure 1. *A stage X embryo (diameter is 3-4 mm)*

Figure 3. *Storage of hatching eggs*

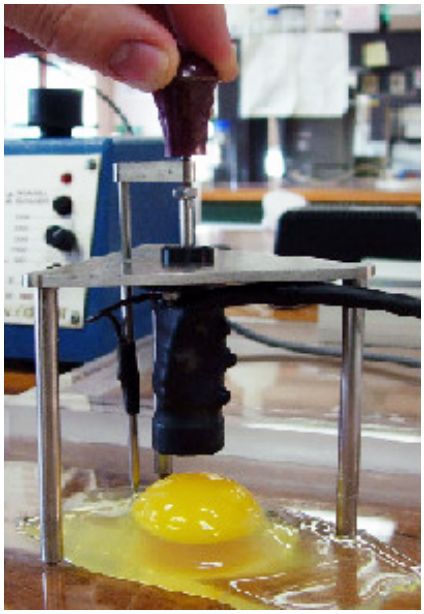

Figure 2. *Measuring albumen height*

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