

Technical Information

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in chick length

cm

HATCHTECH
INCUBATION TECHNOLOGY



T +31 (0) 318 512 511
F +31 (0) 318 517 487

Info@hatchtech.nl
www.hatchtech.nl

How to overcome the negative effects of prolonged egg storage?

I.Reijrink M.Sc, HatchTech Incubation Technology

Due to variable market demands for day old chicks and maximum hatchery capacity, total length of egg storage varies between a few days and several weeks. Egg storage longer than 7 days is associated with a delay in hatch time, a decline in hatchability and a decline in chick quality. After 7 days of storage, hatchability normally declines with 0.5% per day. Chicks of long stored eggs are less developed at day of hatch than chicks of short stored eggs and growth performance in the field is also declined.

The cause of the negative effects of prolonged egg storage is not clear. It can be caused by changes in the embryo and/or by changes in the egg components. During storage cell death in the embryo increases overtime, albumen pH increases from 7.6 to 9 within 4 days, and albumen height and strength of the yolk membrane declines overtime as well. Some of these changes during storage need to occur to support embryonic development. An albumen pH of 9, probably protects the embryo against micro-organisms, while a decline in albumen height is necessary to provide the embryo with sufficient oxygen during early embryonic development.

On the other hand, changes in the embryo and egg components may also have a negative effect on embryo viability. It can be hypothesized that an embryo needs a particular number of viable cells at the onset of incubation to continue embryonic development successfully. Due to cell death, the number of viable cells decreases and this may increase the risk for early embryonic mortality or abnormal development. The cause of the increase in cell death overtime is not clear. It may be a consequence of the length of storage, because cells grow old at a suboptimal temperature. It may also be a consequence of a default in the mitosis cycle when the cycle is started at a suboptimal temperature. Another possibility is that cell death increases due to a prolonged exposure of the embryo to an albumen pH of 9. An albumen pH can also have a negative effect on embryonic development during early incubation. It is known from earlier research that the optimal pH for early embryonic development is 8.2. During the first few days of incubation, albumen pH increases to a pH around 9 in stored as well as in non stored eggs. This does not correspond with the optimal pH for

embryonic development and may induce embryonic mortality or abnormal development especially when embryo viability is declined due to prolonged egg storage.

To prevent the negative effects of prolonged egg storage, cell death should be prevented or compensated and/or changes in the egg components should be prevented. One way to prevent cell death in the embryo and changes in the egg components is storage of eggs at a low temperature (<20°C). When temperature decreases, less changes occur in the embryo and egg components. But only decreasing the storage temperature does not completely solve the negative effects of prolonged egg storage.

The aim of this project is to optimize embryo viability during storage and early incubation to improve hatchability and chick quality after prolonged egg storage. In this project five different methods are used to investigate whether the negative effects of prolonged egg storage are caused by changes in the embryo, changes in the egg components or both. The five methods are: pre-storage incubation, daily warming of eggs during storage, changing the gaseous environment during storage, pre-incubation warming profile and carbon dioxide injection during early incubation.

When pre-storage incubation is used, eggs are incubated for a few hours just after egg collection, and stored afterwards. The aim of pre-storage incubation is to increase the stage of embryonic development to a quiescent developmental stage in which the embryo consists of more cells than at oviposition. Pre-storage incubation can improve hatchability after prolonged egg storage, but whether hatchability is improved is dependent on the developmental stage of the embryo at egg collection and length of pre-storage incubation. Pre-incubation warming profile is the time and curve that is used to increase the internal egg temperature from storage temperature to optimal incubation temperature. Pre-incubation warming profile affects hatchability when egg storage is prolonged. From the results of this project it seems that a slow pre-incubation warming profile (within 24 h from 17°C to 37.8°C) improves hatchability compared with a fast pre-incubation warming profile (within 4 h from 17°C to 37.8°C), but pre-incubation warming profile does not seem to affect chick quality at day of hatch. By using pre-storage incubation and pre-incubation warming profile, cell death is probably compensated and therefore embryo viability is maintained (pre-storage incubation) or recovered (pre-incubation warming) before the onset of incubation.

An increase of the carbon dioxide concentration in air during storage, reduces the increase in albumen pH and reduces the decline in albumen height, but does not seem to have an effect on embryonic development, hatchability and chick quality at day of hatch.

From these preliminary results it seems that an embryo needs a particular number of viable cells or developmental stage at the onset of incubation to continue embryonic development successfully at the onset of incubation after prolonged egg storage. It also seems that cell death is not increased due to a prolonged exposure of the embryo to an albumen pH of 9. A final experiment will be conducted to investigate whether the number of viable cells or the developmental stage of the embryo determines embryo viability at the onset of incubation and to investigate the effect of albumen pH during early incubation on embryonic development, hatchability and chick quality.

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