

# Storage of the avian embryo

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Due to variable market demands for day old chicks in the poultry sector it is common that hatching eggs are stored before incubation starts. Eggs are stored at the breeder farm before they are transported to the hatchery.

After arrival at the hatchery, it normally takes a few days before the eggs are set in the incubators. At both locations eggs are stored in a storage room, where the temperature and relative humidity is controlled. If the storage period is less than seven days a storage temperature of 16-18°C is advised and if the storage period is longer, a temperature of 10-12°C is mostly recommended.

To prevent water loss from the eggs, the relative humidity in the storage room is kept between 70 and 80%. Despite the environmental regulation in the storage room it is commonly known that hatchability declines if the storage period is longer than seven days. On the other hand, it is also known that early embryonic mortality increases if eggs are set on day of oviposition. A short storage period of 3-4 days seems to be necessary for good hatchability.

In practice, longer storage periods are sometimes unavoidable. It is commonly known that eggs of young breeder flocks are better suited for prolonged storage periods than eggs of older breeder flocks, because the albumen quality in eggs of younger breeder flocks is higher.

In nature, storage periods of more than seven days are common as well, because a hen starts incubation when all the eggs of a clutch are laid.

Nevertheless, the detrimental effects of



prolonged storage periods in nature seem to be less than in artificial incubation.

Consequently, an interesting question is: what is the difference between storage in nature and storage before artificial incubation?

## Storage in nature

Storage of eggs in nature seems to be simple. The eggs are laid in a nest and there is no regulation of temperature or relative humidity. Once a day the hen comes to the nest and lays an egg. While the egg is laid the other eggs in the nest are warmed for a short period. If a clutch of eggs is ended incubation starts.

## What happens in the egg?

After oviposition, an egg cools down to ambient temperature and an air cell is formed due to evaporation of water through pores in the shell.

Carbon dioxide is released from the egg, resulting in an increase in albumen pH from 7.6 at oviposition to a pH of 9 to 9.5 within

four days of storage and a decrease in albumen height.

The yolk remains slightly acid during storage, at a pH around 6.5. The loss of carbon dioxide to the environment and thus changes in albumen pH and albumen height is dependent on length of storage period, storage temperature, transport of carbon dioxide through the albumen, conductance of the eggshell and eggshell membranes and the concentration of the carbon dioxide outside the egg.

One of the positive effects of the increase in albumen pH is the protection of the embryo against a bacterial invasion.

Due to the relatively high increase of albumen pH during storage, a pH difference arises between yolk and albumen. This difference might be necessary to facilitate certain transport functions across the albumen and yolk to and from the embryo.

A decrease in albumen height is necessary to meet the oxygen requirements of the embryo during storage and early incubation.

Thus, a change in albumen quality during storage seem to be necessary to protect and support embryo development.

The advice to decrease the storage tem-

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perature if the storage period increases, is to slow down the loss of carbon dioxide from the egg and to slow down the development of the embryo. Excessive loss of water during long term storage has generally been reported to be detrimental for hatchability.

The reason for this is not totally clear. By controlling the temperature and relative humidity in the storage room the processes in the egg are slowed down, but probably not enough to maintain embryo quality after prolonged storage periods. There must be another factor that is important to maintain embryo quality.

Since the beginning of the 20th Century it

is known that a decline in hatchability of avian eggs caused by prolonged storage periods can be reduced by pre-storage incubation. In nature the hen also incubates the eggs every time she lays another egg.

Results of studies done by Fassenko et al. (2001) and Lourens (2001) showed that hatchability of broiler breeder eggs stored for 14 days was significantly better after six hours of pre-storage incubation than without pre-storage incubation.

Lourens (2001) also showed an increase in chick quality. Fassenko et al. (2001) and Lourens (2001) suggested that there is an optimum in the length of the pre-storage incubation period of fresh laid eggs.

After six hours of pre-storage incubation



the embryos had formed the hypoblast (an extra cell layer) completely. It can be hypothesised that an embryo with a higher number of cells is more resistant against a prolonged storage period, because although cell death occurs more viable cells are available for normal growth and development at the start of the incubation process.

Another advantage of the hypoblast stage of development might be that it is a quiescent developmental period. If an embryo is stored at a very active period of development the chance to damage the cells might be higher.

In conclusion, temperature and relative humidity are not the only factors that need to be controlled during long term storage.

The developmental stage of the embryo also seems to be important in order to maximise embryo development, hatchability and chick quality.

In October 2005 Wageningen University in the Netherlands started a PhD project in cooperation with HatchTech Incubation Technology and Hybro on the subject of storage and early incubation of the chicken embryo.

HatchTech also developed a special version of their innovative incubator especially for pre-storage incubation at the breeder farms. The fundamental knowledge and practical experience will help to reduce the negative effect of storage on embryo development, hatchability and chick quality. ■

References are available on request from  
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