HatchTech
INCUBATION TECHNOLOGY

Technical Information

The Mystery of Duck Egg Incubation

Inge Reijrink M.Sc.

Hatchability results of a duck hatchery fluctuates during the year and the reason for disappointing results are often not clear. One of the most important factor influencing hatchability of duck eggs is the cuticle. A dense cuticle covers the pores of a duck eggshell. The purpose of this cuticle is to protect the embryo against micro organisms. The disadvantage is, that gas exchange like the oxygen flow to the embryo and the escape of carbon dioxide and water vapor from the egg is difficult.

To obtain an optimal hatchability and duck quality, an embryo needs a sufficient amount of oxygen to maximize the use of yolk for body development. The average weight loss of a batch of duck eggs must be around 11% at day of transfer to create an air cell, that contains a sufficient amount of air for breathing between internal and external pipping.

In nature, the presence of this dense cuticle is not a disadvantage, because it is partly removed by a surface bacteria (Bacillus Licheniformis) in the first week of incubation. In artificial incubation this bacteria is not present, and the cuticle remains a barrier for sufficient gas exchange and therefore negatively affects hatchability and duck quality. When gas exchange is not sufficient, hatchability is normally reduced by embryonic mortality in the second half of the incubation process. Most of the dead embryos are small but fully developed, and surrounded by a lot of fluid as a result of too less weight loss and a shortage of oxygen.

Cuticle removal

Removal of the cuticle seems to be the most simple solution for the gas exchange problem. In practice, duck eggs can be washed with a chloric solution to remove the cuticle.

Although this solution sounds simple, the practical application is not without risks. The washing procedure must be precisely controlled to minimize cross contamination, which causes hatch losses by an increased amount of rotten eggs. An alternative for washing, is spraying eggs with different chemical fluids, that are able to remove the cuticle or parts of the cuticle. But, also with this method the risk of contamination is increased. It is important to consider whether the risk for contaminated eggs, the labor input and the increase in production costs match the improvement in hatchability. When the cuticle is removed, it might be necessary to increase the relative humidity in the incubator to prevent dehydration of the duck embryo. Depending on the humidifier that is used in the incubator to increase relative humidity, this can cause cold spots in your incubator and this has a negative effect on hatchability and duck quality as well.

Changing incubation conditions

Changing incubation conditions might be a better solution for the gas exchange problem. Water loss from the egg can be changed by adjusting the relative humidity in the incubator. When the average weight loss of a batch of eggs is less than 10%, relative humidity can be reduced to increase weight loss. Although weight loss is increased, the reduction of the relative humidity has a few disadvantages. Relative humidity is an important medium to transfer heat, that helps to warm eggs at the start of incubation and cool them in the second part of incubation. Depending on the design of the incubator, a decrease in relative humidity can negatively affect the uniformity in eggshell temperatures throughout the incubator and this causes differences in embryonic growth and consequently it impaires hatchability and duck quality as well. By decreasing the relative humidity, the oxygen supply for the embryo is not increased and therefore the growth of the embryo is not maximized, because less yolk will be used.

A way to increase the supply of oxygen to the embryo is, by increasing eggshell porosity. In practice, this can be done by punching a hole in the eggshell. However, this increases the risk of egg contamination. Adding extra oxygen in the incubators is technically possible, but practically not feasible, because it is expensive. Reducing the CO2 levels in the machines by increasing the ventilation rate, increases the amount of fresh air in the incubator and might be beneficial, but will influence the incubation process as well, because temperature and relative humidity are also affected.

Since it is difficult to increase the supply of oxygen without a negative side effect, it might be more beneficial to change the oxygen requirement of the embryo. From recent research done by HatchTech, it is known that when incubation temperature increases, the metabolism of the developing embryo increases and consequently the requirements for oxygen increases as well. This mechanism probably also works the other way around. When incubation temperature decreases, the metabolism of the developing embryo slows down and the required oxygen decreases. It is not known what the temperature needs to be to meet the required amount of oxygen. It is also not known yet whether this temperature becomes so low that it has a detrimental affect on embryonic growth and development.

In conclusion, optimizing the incubation process of duck eggs is a challenging process. A lot of factors have to be taken into account. The Research and Development Department of HatchTech Incubation Technology is taking a closer look into this problem and tries to optimize the incubation process and duck quality.

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