HatchTech
INCUBATION TECHNOLOGY

Technical Information

Effect of egg weight and egg weight loss on the hatchwindow

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During the hatching process, not all eggs will hatch at the same moment. The time between the first and last chick that hatches is called the hatchwindow. Factors that might influence the hatchwindow are: 1) the variation in embryonic development before the start of incubation, 2) the variation in eggshell conductance, and 3) the variation in embryo temperatures.

One of the reasons for variation in embryonic development is caused by the variation in developmental stage of embryos before the start of incubation. The difference in eggshell conductance between eggs causes differences in oxygen availability and oxygen availability affects metabolism and development. The size of the air cell might influence the moment of external pipping, consequently affecting hatching time. Besides these 2 factors, also variation in embryo temperatures affects variation in embryo development and therefore the hatchwindow.

Variation in embryo temperatures can be caused by incubator design and variation in egg size. Incubator design influences airflow. When the airflow in an incubator is not uniform, air velocity varies and as a consequence embryo temperatures vary. To minimize the variation in embryo temperatures, it is essential to keep the air velocity within an incubator uniform. A laminar airflow creates an equal velocity and equal embryo temperatures throughout the incubator.

Variation in embryo temperatures increases variation in embryonic development. This is because embryo temperature drives metabolism and metabolism is a criteria for development. Variation in embryonic development increases the hatchwindow. Embryos that are further developed will hatch earlier than embryos which are less developed. Therefore, the key to uniform development are uniform embryo temperatures. Incubating all eggs in an incubator at an embryo temperature between 99.5 and 100.5°F maintains uniform development and does not increase the hatchwindow.

Another factor that influences variation in embryo temperatures is egg size. Larger eggs might have more difficulties to lose heat, because their volume to surface ratio is larger compared to smaller eggs. Therefore, the embryo temperature of larger eggs might be higher than the embryo temperature of smaller eggs at the same air temperature in the incubator. As a consequence, the embryo temperature will be higher in larger eggs than in smaller eggs and because a higher embryo temperature increases embryo development, chicks from larger eggs will hatch earlier than chicks from smaller eggs.

Maintenance of uniform embryo temperatures in small and large eggs can be reached by the correct incubator design that ensures a laminar airflow throughout the incubator. The laminar airflow inside a HatchTech incubator is combined with a high air velocity. Higher air velocity improves heat transfer of eggs, which increases the possibility for larger eggs to lose their heat more easily. High air velocity, therefore, minimizes variation in embryo temperatures caused by differences in egg size.

The HatchTech Research department investigated whether egg weight or egg weight loss influence the hatchwindow when a HatchTech incubator design was used in which laminar airflow and high air velocity are important features.

The hypothesis of the current experiment was that egg weight and egg weight loss influence the hatchwindow in such a way that when eggs would be selected on egg weight and/or egg weight loss, the hatchwindow would become smaller. The experiment was divided in 2 parts. In the first part of the experiment, we investigated the effect of egg weight (between 62 and 65 grams) and egg weight loss during the first 16 days of incubation on the hatchwindow. In the second part of the experiment, we investigated the effect of egg weight selection on the hatchwindow.

Effect of egg weight loss on the hatchwindow

Before set, 1,200 eggs from one prime breeder flock were individually weighed. Nine hundred eggs were selected for an egg weight between 62 and 65 grams.

At day 16 of incubation, eggs that were selected on egg weight were individually weighed again and egg weight loss was calculated. Egg weight loss can be calculated by measuring the egg weight at two time points. Egg weight loss determines the eggshell conductance. The standard procedure is to measure egg weight at set and at transfer. The egg weight loss can be calculated by subtracting the egg weight at transfer from the egg weight at set and divide by the egg weight at set. The egg weight loss is equal to the amount of moisture that the egg has lost during incubation. Eggs that lose a high amount of moisture have a higher eggshell conductance than eggs that lose a low amount of moisture.

After the egg weight loss was calculated, the eggs were divided into 4 categories of egg weight loss: 1) egg weight loss less than 10.0%, 2) egg weight loss of 10.0% and less than 11.0%, 3) egg weight loss of 11.0% and less than 12.0%, 4) egg weight loss of 12.0% or more. Hatching baskets were randomly placed on the hatching trolley.

After an incubation duration of 19 days and 2 hours, every 6 hours the number of hatched chicks was counted. At 20 days and 14 hours, the number of hatched chicks was counted for the last time. The hatching curves of the eggs that were selected on egg weight loss were compared with each other.

were selected on egg weight between 62 and 65 grams on day of set and selected on moisture loss on day 16 of incubation did not differ from each other (P=0.37).

Effect of egg weight on the hatchwindow

At the day of set, 300 eggs of a prime flock were not selected on egg weight. At transfer, these eggs were allocated to 4 hatching baskets which were randomly placed on the hatching trolley. The hatching curve of the non-selected eggs was compared with the hatching curve of the eggs selected on egg weight (between 62 and 65 grams) without taking the difference in eggshell conductance into account.

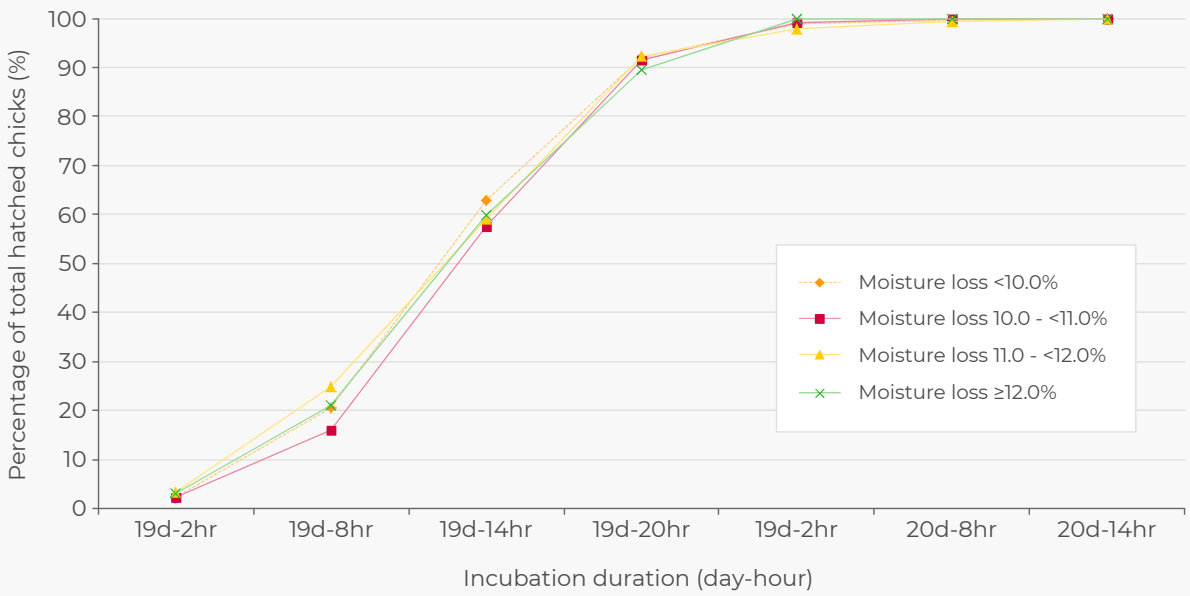

Figure 1: *Percentage hatched chicks cumulative per time when eggs were selected on egg weight and moisture loss*

Results effect of egg weight loss on the hatchwindow

Figure 1 shows the percentage of total hatched chicks during the timeframe of hatching. Twenty four hours after the first chick had hatched; more than 95% of the chicks had hatched from all the groups that were selected on egg weight loss. The hatching curves for the groups of eggs that

After an incubation duration of 19 days and 2 hours, every 6 hours the number of hatched chicks was counted. At 20 days and 14 hours, the number of hatched chicks was counted for the last time. The hatching curves of the eggs selected on egg weight and eggs which were not selected on egg weight were compared to each other.

Results of egg weight on the hatchwindow

Figure 2 shows the percentage of total hatched chicks during the timeframe of hatching. Twenty four hours after the first chick had hatched more than 95% of the chicks had hatched from the group that was selected on egg weight and the group that was not selected on egg weight. However, the shape of the hatching curve of the eggs selected on egg weight between 62 and 65 grams was different than the shape of the hatching curve of the eggs that were not selected on egg weight (P=0.04). A higher percentage of chicks of the non-selected eggs hatched earlier than of the selected eggs. However, the time between the first and last chick that hatched of the non-selected eggs was the same as the time between the first and last chick that hatched of the selected eggs.

and duration of the hatchwindow. However, selection on egg weight between 62 and 65 grams on day of set alone did influence the shape of the hatching curve, but not the duration of the hatchwindow.

Maintaining embryo temperatures between 99.5 and 100.5°F is crucial for optimal and uniform embryonic development. Maintaining embryo temperatures within the range of 99.5 and 100.5°F is more difficult when eggs of different sizes are incubated in one incubator. When the airflow in the incubator is not uniform and the air velocity is low, larger eggs probably have a higher temperature than smaller eggs. Due to higher embryo temperatures in large eggs, chicks from these eggs will hatch earlier. The larger eggs in the non-selected eggs-group in the current experiment might have

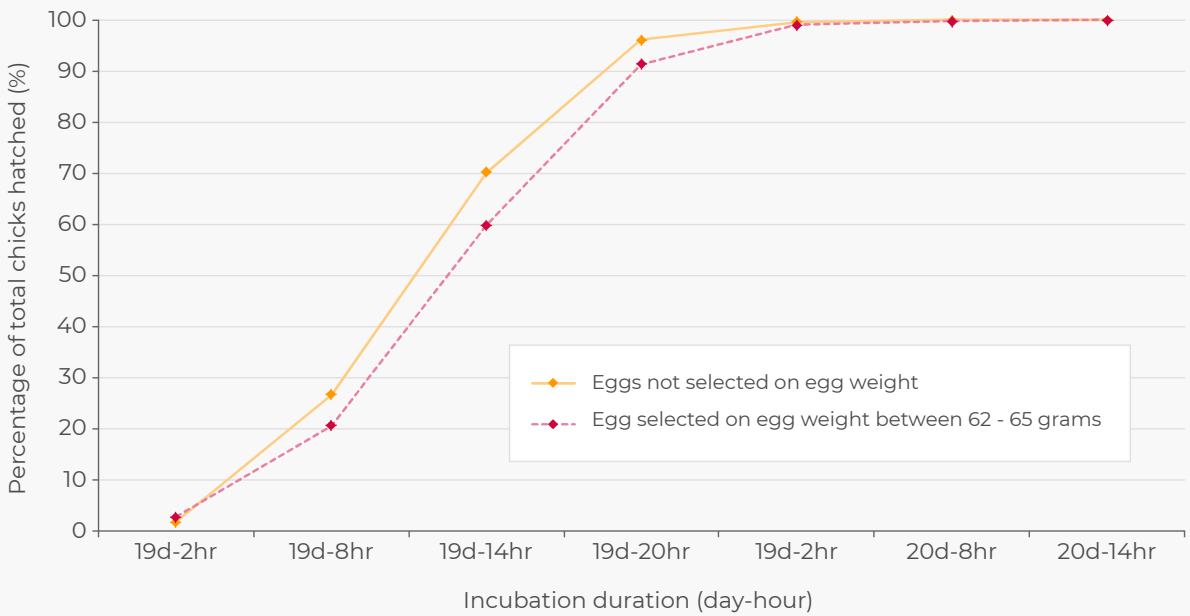

Figure 2: *Percentage hatched chicks cumulative per time when eggs were not selected on egg weight at day of set or selected on egg weight between 62 and 65 grams at day of set.*

Conclusions and discussion

Selection on egg weight at day of set followed by a selection on moisture loss at day 16 of incubation did not influence the shape

hatched earlier than the selected eggs due to slightly higher embryo temperatures. However, the time between the first and the last chick that hatched (duration of

the hatchwindow) was not affected by egg weight selection.

The fact that selection on egg weight did not affect the duration of the hatchwindow might be caused by the incubator design used in the current experiment. Laminar airflow and a high air velocity are important features of a HatchTech incubator. These factors maintain a uniform air temperature inside the incubator, which ensures uniform embryo temperatures between 99.5 and 100.5°F also when eggs of different sizes are incubated in the same incubator.

To summarize, uniform embryo temperatures are essential for uniform embryo development and a small hatchwindow. The effect of eggshell conductance on the hatchwindow seems to be minor probably because only extreme low or high egg weight losses (< 8% and > 15%) affect hatching time. Egg weight seems to affect the shape of the hatching curve, but the time between the first and last chick that hatches does not seem to be affected when a combination of uniform airflow and high air velocity minimize temperature differences between eggs of different sizes. Therefore, incubator design is extremely important and is crucial to minimize the hatchwindow.

Source: Arab World Agribusiness, Volume 28, number 6, page 5-6

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