

Getting it right during incubation to produce high quality chicks

In the course of time, hatcheries have changed in many aspects. Among these vast changes, the biggest one may be the capacity of hatcheries. Today we have to deal with millions instead of thousands of chicks. Thanks to the developing technology, we are now able to deal with it by using the right set ups and procedures.

Dr Tolga Erkus, Aviagen Ltd.
aviagen.com

In commercial hatcheries, we are trying to reproduce the natural conditions of incubation in a nest. Any incubation machine has to provide five basic functions:

- Heating.
- Cooling.
- Humidification.
- Turning.
- Ventilation.

To meet all of these needs and produce high quality chicks, we need to be sure about:

- Egg shell temperatures.
- Weight loss and chick yield.
- Turning.
- Set times and hatch window.

Egg shell temperatures

Egg shell temperature is vital for chick quality and hatchability during incubation. 100°F egg shell temperature is generally accepted as ideal. The embryo starts to produce heat after the fifth day of incubation and this production tends to be at the maximum between days 16-18.

Thus, it should be remembered that the egg shell temperature and machine temperature are totally

different things. Therefore we have to monitor the egg shell temperatures for all stages and have to alter the set point when necessary. The danger pattern is shown in Fig. 1.

The correct setter temperature is critical for hatching good quality chicks. Setter temperature is what is experienced by the embryo inside the egg. It is not the air temperature of the setter.

Eggshell surface temperature is closely related to internal egg temperature. Therefore it is a useful tool to determine whether the setter temperature is correct or not.

Shell temperature can be easily measured using a medical infrared thermometer. Optimum shell temperature for maximum hatch and chick quality is 37.8-38.3°C (100-101°F) throughout the whole setting period.

Weight loss and chick yield

All bird eggs, from sparrow to ostrich, lose 15% of their weight during incubation in nature. In commercial hatcheries, we should try to target 12% until the transfer and 3% after the transfer for fresh eggs.

The weight loss and chick quality are highly correlated. Thus, the excessive percentages of the water loss can cause dehydration or leg issues and can increase late deaths. Therefore the weight loss should be recorded and corrected by modifying the set points.

The 3% loss after transfer can be checked by using the chick yield calculation. Chick yield is calculated as the percentage of chick weight and fresh egg weight ratio. The target should be 67% for fresh eggs.

The reason we need to control

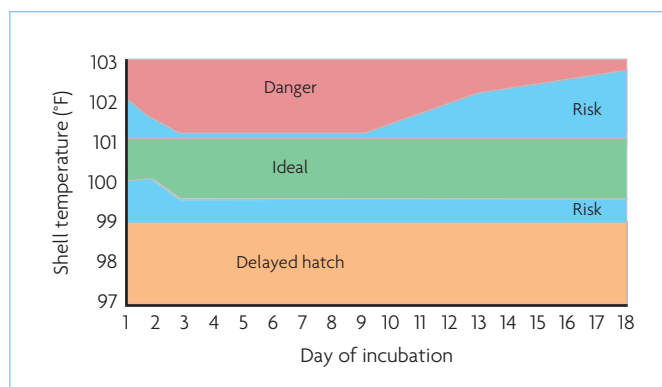


Fig. 1. Monitoring egg shell temperature.

incubator humidity is to control the rate of water loss from the egg.

We can measure water loss by weighing the egg, as all the change in egg weight during incubation is due to the loss of water. A small amount of water is lost from the egg during storage, typically 0.5% per week of storage. This water loss should be subtracted from what can be lost during incubation. Routine monitoring of egg water loss is the best way to check that the incubator humidity is correct, as it uses the egg to tell us what is required.

Making sure the egg weight loss is in the optimal range will maximise hatch and chick quality.

Turning

Turning is one of the key factors needed to provide the optimum conditions for developing embryos; and in modern incubators eggs are held small-end down in trays, which are tilted from side to side at regular intervals. This replaces the hen rotating the eggs lying on their sides in the nest.

The angle of the eggs when turned is important. Hatchability is significantly better in eggs turned at an angle of 45° either side of the vertical when compared to turning at less than 38°. Chicks from eggs turned at the optimal angle will be of better quality.

The turning angle actually delivered in an incubator will be governed by the calibration of the

turning system and its maintenance. Many companies are still using old machines in their hatcheries, while others have brand new incubators.

Whether the machines are new or 50 years old, maintenance, calibration and regular adjustments are the keys for success. This is worth taking into account to optimise incubation conditions, thus achieving high hatchery performances and good chick quality.

There is a lot of old and new literature stating that turning of the eggs with a proper angle during incubation helps the physiological and physical development of the embryo. Turning that does not meet the optima for frequency and angle will affect hatchability, increasing early and late embryo mortality and causing some very specific malpositions in the late dead embryos.

Briefly, turning:

- Prevents the embryo from sticking to the extra embryonic membrane.
- Helps to absorb and utilise albumen.
- Helps to reduce malpositions.
- Helps to achieve targeted hatchability and chick quality.

There are three factors that need to be considered in turning. These include the questions How long?, How frequent? and Which angle?

Turning during the 0-2 day period is associated with dynamics of early changes in the shell membranes and albumen.

In the 3-8 day period, turning has
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 been typically associated with the formation of the sub-embryonic fluid. Finally, turning during the 9-14 day period is associated with malpositions. Although the turning frequency needed gets less as the embryo develops, in practice, turning the eggs once an hour is simple to implement and monitor in commercial hatcheries.

The turning angle is very important. The hatch of the fertile eggs is significantly better in eggs tilted over an angle of 45° to either side of the vertical, as compared to a turning of 30° and 15°.

Also the hatched chicks from eggs turned at 45° weighed more and had less dry matter in the residual yolk. The turning angle is best maintained between 38° and 45° each side of the vertical. Less than 38° will cause decreased hatchability and more than 45° will cause ventilation problems and cracked eggs.

Signs of improper turning

The typical signs and symptoms of turning problems are:

- Increased early embryo mortality. (if turning is insufficient in days 0-7 of incubation).
- Increased late embryo mortality.
- Higher frequency of malposi-

tions, particularly Malposition II (embryo upside down).

- Unabsorbed albumen.
- Sticky chicks due to unabsorbed albumen.

Set times and hatch window

Uniformity of day old chicks is highly valued by hatcheries, customers or farmers.

The weight of chicks at placement is affected by their weight at hatch and the amount of time they are held in the hatcher (chicks that have to wait in the hatcher for prolonged periods will suffer dehydration and weight loss).

Many studies have shown that the effects of chick quality on growth are visible up to the slaughter age. In most cases, estimating the pull time is not easy. Many poultry textbooks state that total incubation time of a chicken egg is 504 hours (21 days). But in reality, incubation varies from 500 hours to 525 hours depending on egg age, flock age, season, machine type, breed etc.

Set times should be adjusted according to these factors. In large hatcheries, hatch takes almost all day. Therefore, hatchers should be grouped and set times of each group should be adjusted according to the pulling times. Also balancing

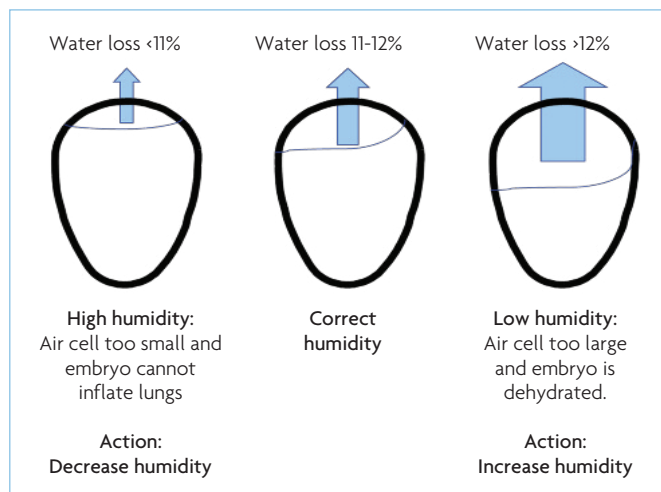


Fig. 2. The importance of controlling incubator humidity.

the set in large machines (according to the flock age, egg age and fertility) will help to get the chicks in a similar time period.

Even if the set times are perfectly right, chicks will not hatch exactly at the same time. The term 'hatch window' describes the period of time over which chicks are actually coming out of eggs.

The 'hatch window' is also called the 'spread of hatch' and it is assessed relative to the time of taking the chicks out of the hatcher.

The spread of hatch is influenced by the variability in temperature in the setters, egg stores or pre-heating process. An even spread of hatched chicks on the hatcher trays during monitoring of the hatch window and reasonably clean egg shells at chick take-off are indicators of good conditions during incubation and the correct take-off time. ■

References are available from the author on request

Fig. 3. Incubation varies from 500 to 525 hours depending on egg age, flock age, season, machine type and breed etc. (Laughlin, 2007).

