HatchTech
INCUBATION TECHNOLOGY

Technical Information

Incubating Eggs Of Different Sizes: It's All About Incubator Design

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Embryo development and chick quality are optimal when the embryo temperature is maintained between 99.5 – 100.5°F throughout incubation. When eggs are not incubated at an embryo temperature between 99.5 – 100.5°F, embryo development is impeded and chick quality at hatch and in later life is negatively affected. Egg shell temperature (EST) is a reflection of the embryo's temperature and can therefore be used in practice to determine the correct machine temperature required for a batch of eggs.

Maintaining all eggs within an incubator at the correct EST is a challenge because varying egg characteristics, such as eggshell conductance and egg size, can lead to variation in EST. When ESTs in a batch of eggs vary, development of some embryos is impeded while it is increased for others. The consequences of variation in development within an incubator are a longer hatch window and reduced chick quality and uniformity, because some embryos are incubated at suboptimal temperatures. Uniform and correct ESTs are vital to ensure optimal hatch results and chick quality.

Egg size and EST

Egg size is one of the egg's characteristics that influence EST. During the second half of incubation, embryonic growth and heat production increase compared to the first part of incubation. From day 15 of incubation onwards, embryos in large eggs have a higher growth rate and a corresponding higher heat production than embryos in small eggs. In addition, large eggs have a relatively small surface area and a relatively large content compared to small eggs. This makes a large egg less capable of removing heat than a small egg.

As a consequence, the EST in large eggs increases more than in small eggs when they are incubated at the same environmental temperature and the embryo inside a large egg is at risk of overheating.

Egg size variation within a flock

Variation in egg size in a batch of eggs in one incubator can occur because of the natural variation in, for example, body weight of the hens within a breeder flock. As a consequence, the eggs that are laid vary in size as well.

When eggs with a large variation in size are set in the same incubator, the incubator design influences the variation in EST. Correct incubator design is crucial to maintain all ESTs within the optimal range of 99.5 - 100.5°F, despite differences in egg size. The conditions within an incubator should allow optimal heat exchange between the eggs and the environment at all locations in the incubator. A uniform air flow is required to ensure an equal air velocity through the incubator. Air velocity plays an important role in allowing an egg to lose surplus heat. High air velocity (> 1 m/s) results in improved heat exchange between an egg and the air and minimizes temperature differences between small and large eggs. A laminar airflow ensures a uniform air velocity throughout the incubator. As a result, all ESTs can be maintained between 99.5 – 100.5°F and optimal conditions can be provided for eggs of different sizes.

Breeder flock age

A second cause of different egg sizes in an incubator is when eggs of breeder flocks with different ages are mixed in one incubator. As a breeder flock ages, eggs increase in size. The largest eggs from an older flock produce much more heat than the smallest eggs from a younger flock. This can lead to more variation in ESTs when eggs of different breeder flock ages are incubated together in one incubator.

To prevent variation in ESTs, it is recommended that eggs from different breeder flocks are set in separate incubators with a suitable temperature profile to maintain ESTs within the optimal range. However, in practice, the large size of incubators – often with capacities of over 100,000 eggs – requires eggs of several breeder flocks to be set within one machine as batches of eggs of one breeder flock are too small to fill one incubator.

Whether a mix of eggs from breeder flocks of different ages results in satisfying hatchability and chick quality also depends on incubator design. HatchTech's incubator design solved the issue of egg size by dividing the incubator into separate, individually controlled sections. A temperature sensor is placed in each section behind the egg mass, accurately measuring heat production for that section. Heating and cooling is immediately adjusted per radiator according to the temperature reading for that section, resulting in independent air temperature control per section. Differences in EST are minimized by the HatchTech incubator. Eggs from all breeder flock ages will hatch high quality, uniform chicks that are able to express their full genetic potential later in life.

Conclusion

Eggs of different sizes – and, correspondingly, with different heat production – can be set within the same incubator when the machine has a laminar air flow combined with a high air velocity. This ensures minimum variation in ESTs within a batch of eggs of one breeder flock age. Eggs from different breeder flock ages can be set within one HatchTech incubator because it is divided into different sections, essentially creating separate incubators with independent air temperature control. As a result, all eggs are in their optimal incubation environment, resulting in high quality, uniform hatchlings.

Source:

Middle East Agrifood Publishers

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