Understanding the multiple variables of commercial incubation

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Incubation on a commercial scale involves numerous variables. These relate not only to the flock type and conditions experienced by the egg prior to incubation but also to temperature, ventilation and other parameters inside the hatching equipment.

The needs and sensitivities of the developing embryo change significantly throughout the incubation process, and so do many of the variables. Only by understanding and controlling these variables meticulously can hatchery managers achieve the best incubation results.

Below, we look at each of these variables to help you gain a deeper understanding of the incubation process.

Expressed in simple terms, the overall targets of any hatchery are to maximise the number of chicks, to achieve the highest chick quality and to obtain the highest possible chick uniformity.

These targets can only be achieved by creating the best possible incubation environment. This, however, is not easy, since numerous parameters have to be considered, including:

- Egg properties.
- Conditions in the hatchery prior to incubation.
- Conditions and location inside the incubator.

Varying hatching eggs

Each batch of hatching eggs is unique in terms of genetics, flock age, breeder house management, and individual bird characteristics. This results in variations in size, fertility and shell quality. Furthermore, transport conditions, storage, fumigation, pre-heating and general handling also have a significant effect on egg requirements.

In addition, elements such as seasonal influences and altitude equally need to be taken into account. As a result, development times, energy absorption and dissipation factors, as well as gaseous and fluid exchange rates will be different from one egg to another.

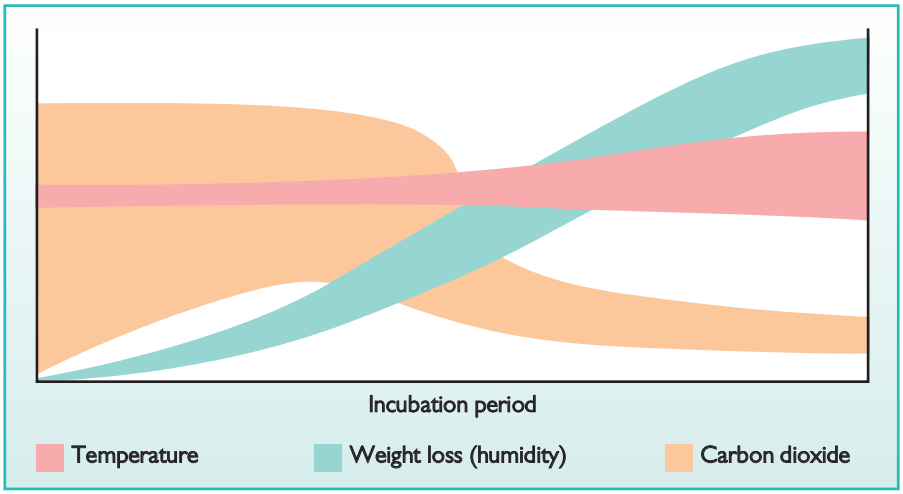

Fig. 1. Several bandwidths are at play inside every large scale commercial incubator.

An appropriate incubation environment, suitable for each individual egg present in the cabinet, must therefore be created.

Multiple variables

Inside the machine, egg hatching is stimulated and controlled by a combination of temperature, ventilation, humidity and gaseous exchange. The level of these factors varies within bandwidths that occur in any large-scale commercial incubator. The only way of achieving optimum performance is by identifying and understanding these bandwidths, and associating hatch data results accordingly.

Temperature regulation is key to achieving successful incubation. When an egg's temperature is adequately controlled, the embryo will develop into a healthy chick.

The minimum and maximum temperature for successful incubation – also called temperature bandwidth – vary throughout the incubation process. This variation occurs in terms of both absolute temperature and differential temperature.

The only practical method of ensuring an appropriate temperature profile in large scale commercial incubation is to mix the air surrounding the eggs.

The laws of physics state, though, that air moved through a resistance creates varying air flows.

Combined with the eggs' energy absorption and dissipation, a second bandwidth of lesser and greater air movement is created and needs to be taken into account.

Such differentials can also be applied to gaseous exchange. Humidity and gaseous levels operate within a bandwidth as well.

Their absolute values and differentials change considerably throughout the incubation process, making the latter extremely complex to manage.

Egg position

Successful incubation also depends on where each egg is positioned on the setter and hatcher trolley, and on the subsequent position of that trolley. The heated, cooled or humidified air that regulates both temperature and air quality levels inside the incubator will have one or more points of entry, either into the cabinet or when adjusting internal airflow circulation.

When fresh air comes in at a point of entry, or when the heaters, coolers or humidifier systems are active, eggs close to that point will be more affected (primary effect) than the others (secondary effect).

Although this effect can be partly mitigated by passing the fresh air through a mixing chamber before it is delivered to the eggs, it cannot be eliminated.

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Larger eggs, therefore, are better placed near points of entry in order to receive the primary effect, as they generally find it harder to lose heat and so require additional cooling down.

In other words, identifying the primary and secondary positions of eggs can also play an important role.

Incubation process

Only by thoroughly understanding each of these variables can hatchery managers use them in a beneficial way. Fully grasping the events inside the equipment and associating them with the results is essential for successful and consistent performance.

Clearly, hatchery managers are faced with a considerable challenge. To continuously achieve an optimal incubation environment, they must either control all incubation variables manually or use equipment such as an Embryo-Response Incubation system, which automatically adapts the hatching environment to the needs of every egg batch.

It constantly monitors embryo behaviour and mimics the natural breeding process as closely as possible. Moreover, it offers direct feedback to the control system in order to achieve an optimal environment, thus simplifying the task of the hatchery manager. ■

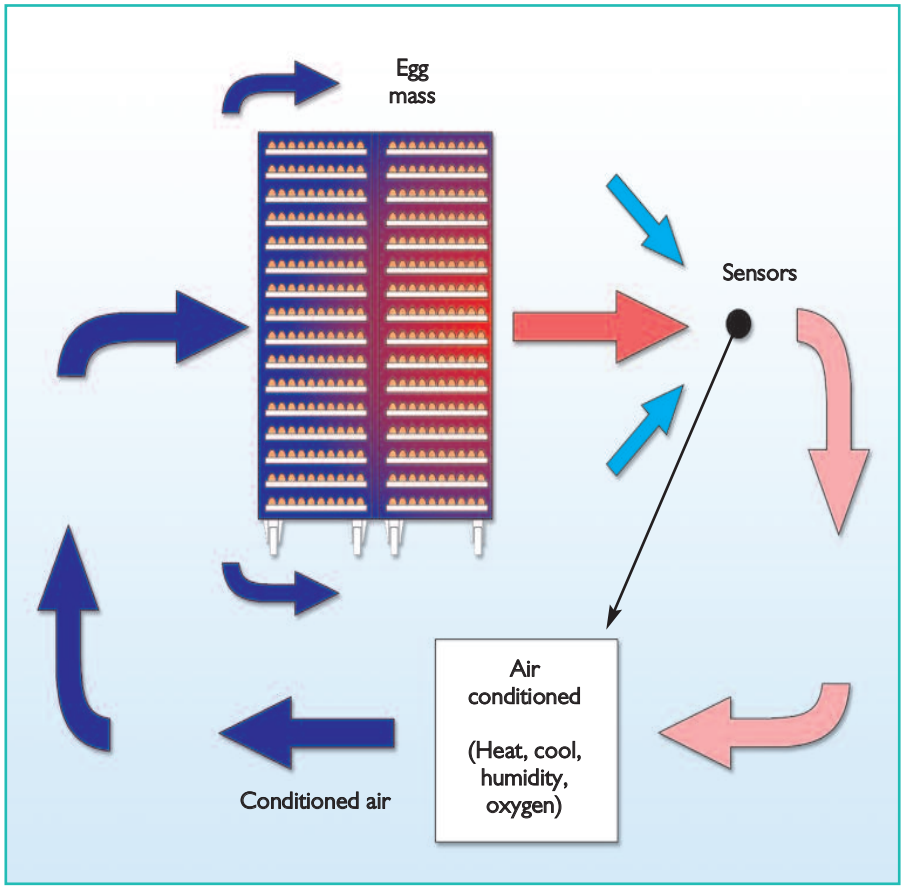

Fig. 2. Any air flow resistance results in heat dissipation.