Energy saving in incubation and brooding

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Energy is an important cost factor in the poultry industry. As both incubation and brooding is done at high environmental temperatures, the energy costs of these processes are relatively high and the impact of a reduction in energy costs can be significant for the bottom line profit of a company.

However, we have to be careful with our reduction in energy costs, as the demands of the embryo and the young chick in temperature are very specific. If we do not meet these demands, the embryos and birds will not develop optimally. A reduction in energy costs should not lead to a reduction in performance.

If we try to safe energy by reducing the environmental temperature, there is a risk that the environmental conditions become sub-optimal for the birds and embryos and that development and growth will be reduced. When birds or embryos are growing they produce metabolic heat as wel,l as this is a byproduct of the metabolism. A sub-optimal temperature will not only lead to a reduction in production performance, but at the end we might have to maintain a higher temperature for a longer time, to compensate for the reduction in heat production. This means that at the end we will have a reduction in performance without a substantial saving of energy.

Achieving a balance

Traditionally, an effective way of energy saving in incubation is the multi-stage concept where eggs in different stages of the incubation process are placed together in the same machine. In this way, the heat produced by the embryos at the end of the incubation process is used to heat up the starting eggs. Because of the equalising effect, less heating is required for the starting eggs and less cooling for the eggs at the end of the incubation process.

In recent years, we have become more and more aware of the disadvantages of multi-stage incubators. In a multi-stage machine one temperature is set for all eggs, as all eggs are in the same machine. Using one temperature for all eggs means in practice that the starting eggs will normally be slightly below their optimum temperature, while the eggs at the end of the incubation process will be higher than optimum.

Both too low and too high temperatures will not result in optimum development and optimum chick quality, even if the hatchability by itself still does not show a problem.

Nowadays a substantial amount of research is focusing on the effect of incubation conditions on broiler performance later on and it has clearly shown that sub-optimal conditions during incubation can have a negative effect on performance, and therefore on bottom line results.

This does not mean that multi-stage incubation will automatically lead to a decrease in chick quality compared to single-stage incubation.

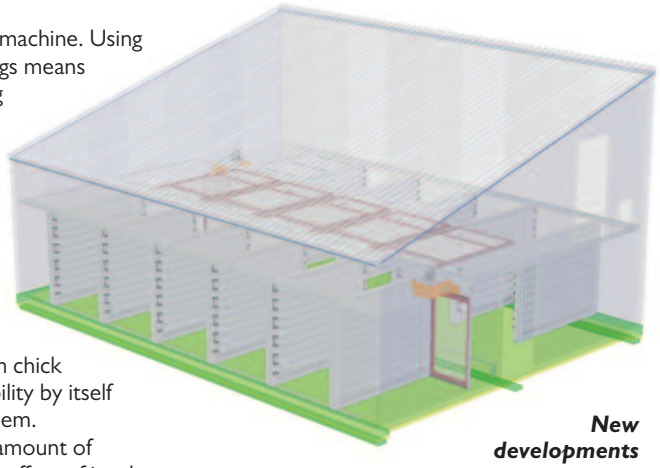
One of the advantages of multi-stage incubation is that it is a simple and robust system, where things will not go very wrong easily. Single-stage incubation gives the opportunity to set the conditions exactly to the needs of the embryo to achieve optimum development. To utilise this opportunity and benefit from the advantages that full control of the incubation process gives us, fine tuning in single stage machines is very important.

Energy efficiency

Usually, multi-stage incubation is considered to be more energy efficient than single-stage incubation. Nowadays we know that the issue is more complex than just that.

First of all, optimal incubation results in increased development, increased utilisation of energy from the egg into the embryo, and therefore increased metabolic heat production.

If incubation is optimised, the result is a net surplus of heat. It is often not the heat that we have to put into the process that is important, but the total amount of cooling



New developments in brooding focus on energy savings.

needed to take the produced heat out of the machines.

In a hatchery there are many individual single stage machines that need heating at the start and cooling at the end. To save energy, the surplus heat has to be moved from one machine (end of incubation) to another machine (start of incubation).

In fact in single-stage incubation the individual machines are single-stage, but the whole hatchery by itself is still multi-stage, allowing the energy to be used efficiently.

Transfer of heat

Transferring the heat from one incubator to another, is therefore an important issue in saving energy in a single-stage hatchery.

In incubators that have cooling coils, we expect that the majority of the heat is captured in the cooling water and, therefore, can be re-generated and used for heating up the starting eggs in another incubator.

However, not only cooling coils take out heat, but also air exchange and evaporation of water and this heat cannot be recaptured so easily as it will leave the hatchery with the outgoing air.

The amount of heat that is lost like this can be substantial and has an impact on the incubation process itself as well, both in multi-stage and in single-stage incubation.

If we calculate the requirements for an

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embryo, it shows that quite a large amount of the total ventilation and the amount of water spray that we use in a hatchery is not for providing the embryo with oxygen and controlling the relative humidity in the incubators, but actually for taking out the heat that is produced by the embryos.

If the ventilation and spraying is reduced to increase the stability and temperature control of the machines, more cooling capacity is needed to compensate.

Temperature in brooding

During brooding we are dealing with the same type of processes as in incubation, but the approach to the problem is different.

Birds are warm blooded, so they need a specific body temperature to feel comfortable. Dependent on the way we measure it, we usually assume that the birds feel comfortable at a body temperature of 40°C (104°F).

The first few days after hatch their thermoregulation system is not fully developed. During these days, the birds are fully dependent on the climatic conditions to maintain their body temperature.

This means that if their heat production and their heat loss is not in balance, they will quickly get too cold or too hot, without having a sufficient mechanism to correct it.

As soon as the body temperature of a chick is not optimal anymore and especially when it is too cold, the first reaction will be to stop moving around and to stop eating. If a bird stops eating and growing it will not produce a lot of metabolic heat and it will stay cold. As a result, the environmental temperature needs to be up for a longer time, to supply the bird with the heat that otherwise it would have produced itself by simply growing.

If the bird eats and consequently grows, it will start to produce heat and the environmental temperature has to be reduced quickly to prevent the bird from getting overheated.

Temperature control gives happy, healthy and profitable chicks.

Saving energy by not heating up a broiler house sufficiently works negatively in two ways. First of all, the birds will not grow well in the first days, which is crucial for later performance.

An impaired growth in the first week will have a negative impact on final broiler results. Not only is the average growth and feed conversion impaired, but the uniformity will also be decreased as some birds will suffer more from the low temperatures and take longer to start than others.

The second problem is that saving energy by not (pre-)heating sufficiently often does not even save energy, because we have to keep the house at a higher temperature for a longer period. The net result is that the energy savings are often limited or not even there.

One of the most important heat sources in a poultry house is the metabolic heat of the birds itself, which is produced as a byproduct of the growth.

By optimising and maximising growth, we can very efficiently safe on energy costs without compromising bird performance.

New developments in housing systems that help us to optimise the conditions during brooding are very interesting for the industry, as it will help to reduce costs and optimise production at the same time. ■