Investigating the reasons behind a poor hatch

Hatcheries – like most other production facilities – base their operations on planning. The results of future hatches can be estimated quite precisely. Knowing breed standards, a hatchery's own general experience, and previous hatchability of eggs from the same source allows us to estimate tendencies and predict the number of chicks expected in the next hatch. This is important, because output must match the orders. Farms can accept only limited deviations.

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Nevertheless, surprises happen – even in the best hatcheries. Let's assume that an unexpectedly poor hatch has happened in a hatchery using a well-known egg source and a proven incubation programme. Nothing was knowingly changed in the basic procedures like egg reception, storage, disinfection, egg preparations and the incubation programme.

A poor hatch – substantially deviating from expectations – is usually a combination of two negative effects: fewer chicks produced and poor quality of those chicks. Both are a problem. The commercial issues related to a disappointed customer might become costly, but they can be solved.

For the hatchery itself the burning questions are: What happened? What failed and why? How can we make sure these problems don't happen again?

To answer these questions, we need to investigate the case in detail. The first step needed is information gathering.

What is the scope of the problem?

Was the poor result limited to just one particular unit? For example, a physical part of the hatchery: hall, group of machines, a single setter, some hatchers or even a single hatcher? Maybe just to a part of one machine? Maybe just to a particular technical procedure or handling? Maybe to a certain truck delivering the eggs? Maybe just to one batch of eggs? What do the affected units have in common?

It might be the air supply, electricity connection, piping, controllers, water chiller, or perhaps some factor at the breeder farm: treatment given to a breeder flock, a technical issue in a poultry house, disease, recent spiking of males, or something else? This helps to narrow down the investigation.

What picture do you see at candling (early or combined with transfer) and at hatch?

Once we have identified the affected unit, we must look into the details. To identify the cause, we need to know in which phase embryo development stopped. Was it a drop in fertility or in hatchability? A sharp drop in fertility is rare. If it does happen, the farm manager usually knows the cause, and the effects are long lasting. Even if all males were removed from the house, fertility would decrease slowly over a period of more than a week.

A much more likely cause of a drop in hatchability is the influence of some physical factor that is killing the embryos. Each physical factor affecting embryo development plays a different role in the successive phases of incubation. Identifying the timing at which most embryos failed helps to pinpoint which factor is responsible for the damage.

The first distinction can be made based on a rough timing of embryo mortality. It might be one of the following:

- **Mortality prior to incubation or during the first days of incubation.**

Nutritional deficiency or advancing flock age are unlikely to be the causes of a sharp increase in mortality at this stage, as these tend to progress gradually, bringing fewer sudden effects. A much more likely cause is intoxication resulting from

presence of drugs (for example, nicarbazin) in a new feed delivery, mycotoxin contamination, or using wrong, expired or just poorly mixed feed ingredients.

These would probably affect the entire flock receiving this feed, although a local problem related to moulds developing in a certain silo is also possible. An acute outbreak of a disease has a long-term effect and will be visible in all batches of the same origin. Another possibility is the operational, technical factors resulting from changed egg handling procedures, where this might not even be realised if strict control procedures are not followed.

Any changed conditions – in the farm's egg storage, disinfection system (wherever disinfection is applied), technical status of a delivery truck, prolonged transport of the affected batch in hot weather on a bumpy road – deserve special attention here.

A sudden increase in the number of clears – which will probably only be noticed at transfer – requires further investigation. Were the eggs ever fertile? Did the embryos die before setting due to poor transport, or bad storage? Or did they die later, during the first days of incubation? To distinguish accurately between early-dead and infertile eggs a break-out needs to be done, and done early enough. If done at transfer, the result will be not reliable.

To diagnose the problem, candling (at least of samples) at a much earlier phase, or even opening fresh eggs just after transport, can be helpful. The latter will not prove whether embryos are alive or dead, but it can reveal their phase of development. If transportation was lengthy and at a high temperature, embryos will pass the optimum stage and can no longer be stored. The embryonic plate will be much bigger than normal, and embryos will die in the first days of incubation.

Embryo mortality during the first days of incubation cannot be caused by insufficient ventilation or excessively high or low humidity. To develop in this phase, embryos need only the correct temperature and turning. A defective temperature sensor can potentially cause serious damage, but in a machine equipped with more than one sensor the effect will only be local.

Lack of turning (especially during the first days of incubation) or defective turning (where the turning angle is insufficient) would cause a drop in hatchability and an increased number of embryo abnormalities seen at break-out of unhatched eggs. These technical defects are also likely to only have localised consequences and therefore only affect part of the load.

- **Mortality in the late days of incubation:**

A sudden, excessive rise in embryo mortality during the middle part of the incubation process is fairly rare. Most unexpected drops in hatchability are the result of late embryo mortality, but might stem from problems arising much earlier, even right at the beginning of incubation.

The presence of large groups of highly developed embryos all dying at the same age during the later stage of incubation, frequently combined with weak, tired survivors, points to a common problem. They were developing successfully until a certain moment, which means that the previous conditions must have been good enough. But like long-distance runners, they 'hit the wall'

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towards the end of the race. What might 'the wall' be in this case?

Different scenarios are possible. Towards the end of incubation, large embryos enclosed tightly by the eggshell become very sensitive to overheating and insufficient ventilation. The most common reason for increased late embryo mortality is the ventilation having cut out for too long. Ventilation provides both fresh air and air cooling. The demand for ventilation increases quickly after day 10 and becomes critical during the last days of incubation.

Lack of oxygen becomes the fastest killer at that age. When looking for the reason for poor hatch, it is important to look carefully at the climate history, even hour by hour, from day 15 onwards, as it is quite likely the explanation will be found here. Detailed investigation is necessary because even a relatively short break in ventilation – as little as 30 minutes – can cause a lot of damage.

A high percentage of dead in shells with a wet appearance, together with small air cells, are a sign of insufficient egg weight loss. As a matter of fact, this kind of mortality is another type of suffocation: embryos 'drown in their shells', as the air cells are too small. To avoid this happening, it is important to take control over evaporation early enough to ensure final optimum egg weight loss.

If relative humidity runs out of control in a particular machine that is executing a proven incubation programme, look for possible water leakage or a defective sensor, resulting in an increase in the real level of humidity above the set point. The wrong application of some kinds of disinfectant (for example using the incorrect concentration) may result in the pores of the shells becoming blocked, which will in turn hamper gas exchange and water evaporation and thus impede development of the air cells.

Temperature remains critical throughout incubation. It acts like the gas pedal in a car – accelerating the metabolic processes if pressed more (too high) and slowing them down if pressed less (too low). The optimum range is narrow, so temperature can easily become either too low or too high. Overheating leads to weak chicks or can even kill embryos in shells. The survivors will be tired, and too exhausted to complete the hatch.

Many will end up as live in shells or external pips. Too low temperatures will slow down development, delay the hatch and also make embryos too weak to hatch. Embryos and chicks will be small and retarded in development. In the affected unit, check the temperature sensor and cooling functions and revise the ventilation.

Many embryos in malposition suggests that eggs might have been placed sharp end up. Although affected embryos die late, the problems may stem from the very first incubation days. Another cause might be that the turning system is not working properly.

Setter or hatcher mortality?

Poor hatch results often go hand in hand with poor chick quality. In the hatcher, the effects of incubation in the setter and the influence of the hatcher conditions combine and accumulate. In the case of a poor hatch, the fundamental question is: where is the problem that caused the poor hatch? In the setter or in the hatcher? While symptoms may overlap, setter problems are likely to show up in many hatchers, unless only one section of the setter was defective.

A break-out of unhatched eggs and their distribution in the machine will provide more information. Many embryos dying during the internal or external pipping phase suggests the problem is to be found in the hatcher rather than the setter. The last days that the eggs spend in the hatcher are critical. The embryos are big, and they need a lot of fresh air and cooling. Too little ventilation and poor uniformity of temperature in the machine become dangerous.

Water leakage (causing a cold zone in the machine), a blockage in the cold-water supply to the cooling system, defective sensors, a blocked ventilation valve, ignored alarms – whether by chance, mistake or lack of knowledge – are all possible items that should be checked first.

A potentially uneven distribution of chicken quality and embryo mortality in the machine is mostly likely to be related to ventilation issues such as a disturbed air circuit. It may also be due to incorrect positioning of the dollies, or of the baskets on the dollies, or wrong settings of the supply and exhaust air pressures.

Finally, the chicks, the survivors, may 'tell us' what their problem was. Typically, symptoms like big, hard bellies, often combined with poorly closed navels, suggest humidity issues.

Are the navels dry or wet? At what height were the shells pipped? Tired, exhausted chicks with red spots above their beaks, red hocks and short fluff on their heads are all indications that their temperature should be checked. Could traces of blood be seen inside the shells? How was the humidity of the shells? Were the shells clean or dirty? Sticky chicks – maybe there was a turning problem?

This may seem like a lot of questions, but they need to be asked and answered in order to avoid disappointing hatch results happening again. ■

IF A POOR HATCH HAPPENS:

- Localise the problem: which part of the hatchery and which phase of the process?
- Analyse the symptoms and identify their likely technical background.
- Identify timing of excessive embryo mortality and relate this to the most likely causes.
- If early mortality is the case, discuss this with the egg supplier.
- Revise your own routines and procedures. Check if anything has changed there.
- Do not overreact. Do not change a successful incubation programme too quickly.
- Check all other machines preventively, to avoid this problem happening again.