Data analysis: a critical path to improved hatchability

41

www.pasreform.com

by Marleen Boerjan, Director Research & Development, Pas Reform Academy

In most hatcheries, the routine monitoring of incubation is based on data collected at each stage in the process. This is an important element of specific protocols for quality control and the optimisation of hatchery results.

For each step in the incubation process, quantifiable criteria have been defined. The hatchability of eggs set is one such quantifiable criterion, defined as the number of saleable chicks hatched from the total number of eggs from a certain batch/flock loaded in one or more incubators. For each age group, hatchability based on eggs set is used to determine an internal standard/reference for that group.

The internal standard is a benchmark that allows the evaluation of:

- Overall differences and variation in hatchery results.
- The influence of flock origin on the variation of hatchery results.
- The influence of storage on the variation of hatchery results.

This article focuses on variability in the hatchability of eggs from one breed, delivered by different breeder farms to the same hatchery. The ultimate aim is to reduce variability between breeder farms and thereby optimise hatchery results overall.

The hatchability of eggs set is dependent not only on breeder farm management, but also on hatchery related factors, such as storage conditions or incubation programs.

Our analysis is based on data collected over several years, from different flocks incubated at one specific hatchery. With only one breed-type to consider, we can assume that factors related to incubation management are averaged for all flocks and breeder farms throughout the recorded period. We may also therefore assume that in the following example, the main cause of variability is related to breeder farm management, including egg handling at the farm and during transport.

In a comparison of hatchability data from two farmhouses, eggs were received and incubated at a specific hatchery, using standard incubation protocols (Fig. 1).

Hatchability of eggs produced by Farm 1 is below the standard (overall average hatchability), except for flocks aged 41-45 weeks.

Conversely, the hatchability of eggs received from Farm 2, incubated in the same hatchery using the same incubation protocols, deliver above average hatchability (grey bars) for all flock ages.

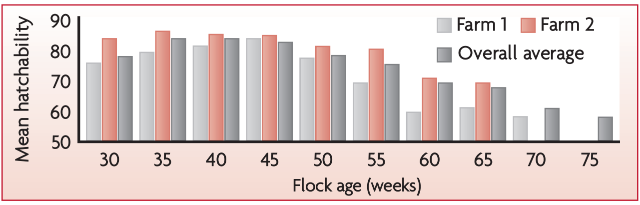
The results suggest that Farm 2 pays greater attention to optimising breeder farm management and egg handling, both at the farm and during transit.

With such attention to these factors, Farm 1 could increase its total number of saleable chicks and improve hatchery performance and results overall.

Advice

- Define a hatchery specific standard based on the average hatchability of eggs set per age group.
- Routinely apply quality control to eggs received from every farm supplying the hatchery.
- Compile and use a troubleshooting list. Reduced hatchability can be expected if eggs received are of poorer quality: poor shell quality and hairline cracks, more dirty eggs, a higher number of floor eggs and eggs placed sharp-end up, for example.
- Include candling and break-out procedures (e.g. 10 day candling) as standard. This will routinely identify and/or discount reduced true fertility or increased early mortality as causes of variation in hatchability.
- Communicate the results of your investigations with the breeder farm manager, as an important start to identifying the cause of below average hatchability results.
- Evaluate the effects of modifications to management practice on the hatchability of eggs set. ■

Fig. 1. Percent hatchabilities of eggs (stored less than eight days) from Farm 1 (light grey) and Farm 2 (red) compared to the overall average (dark grey).



Tel: +31 314 659 111 • academy@pasreform.com

Hatchery flooring and drainage: boosting performance 42

www.pasreform.com

by Férenc Elshof, project engineer, Pas Reform Academy

The quality and construction of hatchery flooring can contribute significantly to operational productivity and cost efficiency.

Load bearing capacity is established from a concrete base layer, reinforced with steel or concrete, depending on the strength and stability of the natural substrate. Building then continues upwards, starting with a sub-base of compacted granular material or lean-mix concrete, followed by a damp-proof layer, insulation, reinforced concrete and a water-tight top finish.

Completed, the floor is flat and level, highly resistant to pressure washing and chemicals, and strong enough to withstand both concentrated and moving (wheeled) loads. A loaded 115k egg capacity incubator weighs approx. 450kg/m^2, while trolleys filled with hatching eggs, repeatedly travelling the same path on typically polyamide or vulcanised rubber wheels, generate very high contact pressures of ±5-15N/mm^2.

An hygienic, easy to clean, anti-skid surface can be achieved with a monolithic (poured as a single slab) build-up, mechanically sanding then plastering the surface, which is finally sprinkled with a wear resistant additive during drying.

Alternatively, and more commonly in modern hatcheries, a cement-bonded base with synthetic finishing layers delivers better performance and durability. Combined with Microban, the synthetic resin surface also provides continuous antimicrobial protection.

Seamless, mechanical installation creates a hygienic, extremely hard-wearing finish, with the resin layering process delivering improved chemical and thermal resistance, durability and easy maintenance over time.

Resin screeds also create a good seal with walls and can be installed with skirting, for improved cleaning.

This type of flooring is fully chemically bonded to the concrete substrate, which prevents the collection of dirt or bacterial contamination in joints or hollows under the finished floor.

High-speed installation produces greater efficiency in the building schedule, ultimately reducing total project lead-times.

Drainage is factored into the build of the floor, with a slope to remove wastewater and promote good drainage.

Drains and gulleys are situated in processing areas and passages, where easy access for regular cleaning reduces the level and subsequent risk of contamination. With a smooth, durable surface, stainless (AISI 304) drains are easily cleaned and strong enough to support the weight of moving loads. Wide, grilled drains are recommended for areas such as the hatcher room, washing and chick handling areas, where a larger capacity is more efficient for the removal of egg shell and other detritus during washdowns. Narrow drains are suitable in hallways and less polluted areas.

Advice

Floors:

- Consult a concrete specialist, to specify the floor correctly for purpose, load and long-life.
- Prevent cracking by reinforcing the concrete with steel.
- Level the floors under setters and hatchers to a grade of 1%, or within 2mm per 1000mm, and flat to within 3mm per 1000mm (Class 2 conform NEN-2747).
- Place floor joints in the centre of panel walls, not under hatchery equipment, whenever possible.
- Avoid the use of glazed floor tiles, which create a slip-hazard when wet and are prone to cracking and breaking, which creates dirt-traps.
- Select an installation supplier who will honour a guarantee on your floors.
- Consider using Microban in the finishing layer, for continuous antimicrobial protection.

Drains:

- Locate drains close to setters and hatchers, to remove wastewater from washing between cycles and help to dry these areas thoroughly and quickly.
- Install floor drains with the recommended slope or grade of 1%.
- Select the pitch or mesh rating for drain grills and gulley covers such that waste water and small eggshell particles are washed away effectively, without impeding or disrupting the travel of trolleys carrying eggs.
- Build-in floor drains to a depth of approx. 160mm, with suitable piping of 110/125mm.
- Install a waste trap at the end of each drain, to prevent fluff and solid waste from entering the drain piping system. ■

Tel: +31 314 659 111 • academy@pasreform.com

Hatcher basket hygiene for a clean start

43

www.pasreform.com

by Gerd de Lange, Senior Poultry Specialist, Pas Reform Academy

The hygiene status of the environment into which chicks are hatched has a direct impact on day-old-chick quality and first week mortality.

The first environment encountered by the chicks is the hatcher basket and its contents. Hatcher baskets are used intensively, often twice a week. Keeping them scrupulously clean between cycles will pay dividends.

Weak egg shells combined with breakage due to rough handling during transfer can smear the chick's down – and these chicks are often culled, to avoid customer complaints. Exploding eggs, due to contamination, expose the newly hatched chicks to a high bacterial challenge. In suboptimal incubation conditions, chicks that hatch without a fully closed navel are most vulnerable, as this forms a point of entry for pathogens that will lead ultimately to increased first week mortality by yolk sac infection.

Eggs should be transferred in properly cleaned and disinfected hatcher baskets. Dirt left behind from a previous hatching cycle, such as meconium (the greenish droppings produced by the chicks), pieces of eggshell, fluff, blood and egg contents, should be thoroughly removed prior to disinfection.

Hatcher baskets are best washed directly after the removal of chicks and hatch residue. Washing hatcher baskets manually with a scrubber, or semi-manually with a high pressure cleaner, can give results that equal washing in a purpose-designed automatic washing machine, but it is very labour intensive. In more sophisticated automated washing systems, a stacking and destacking module allows pre-soaking time, for thorough, easier cleaning.

Other measures for optimised cleaning and disinfection are:

- Temperature: washing water should not be higher than 50-60°C, to prevent the coagulation of proteins. At minimum, 40°C will give adequate cleaning results.
- Detergent: use an alkaline-non foaming detergent (with or without hypochlorite) at the recommended concentration, alternating occasionally with an acid detergent, to prevent the build-up of scale.
- Mechanical effect: Maintain the pressure and direction of the washing water; for example quality of nozzles and proper adjustment. Higher pressure gives better results.
- Time: The speed with which the hatcher baskets pass through washing; slower transit produces better cleaning results.
- Rinse thoroughly with clean water.
- Follow washing with disinfection, using a broad-spectrum disinfectant.

A hatcher basket manufactured to include a microbiological agent in the polymer from which it is made provides continuous protection between cleaning cycles.

If the washing process gives good cleaning results, there is no benefit to using paper in the baskets, unless the batch includes many exploders.

In this case, the paper will absorb some of the mess and the chicks are more likely to stay clean. The use of paper with high absorbency and enough grip for the chicks to avoid 'splay legs' is recommended.

Newspaper is not suitable. If paper is used, check that it does not hamper air flow over the eggs and hatched chicks by making sure that it fits inside the base of the basket – and cover entirely with eggs, to keep it down.

Advice

- Clean and disinfect hatcher baskets thoroughly after every use.
- Evaluate cleaning results regularly by visual inspection and take corrective action when needed.
- Monitor the effect of disinfection by taking staking swabs or Rodac-plates.
- Allow baskets to dry thoroughly before the next transfer; consider an extra set of hatcher baskets if this cannot be achieved.
- Consider whether to use paper in the hatcher baskets carefully: incorrect use will have a negative impact on airflow and could affect hatchability and chick quality. ■

Tel: +31 314 659 111 • academy@pasreform.com

Circadian Incubation – a new feature of single stage incubation

44

www.pasreform.com

by Dr Marleen Boerjan, Director Research & Development, Pas Reform Academy

We know that a combination of genetic and environmental factors shape the embryonic body as well as the formation and maturation of functional tissues and organs.

While the genetic make-up of the chicken embryo contains basic instructions for the development and formation of the body, developmental fine-tuning occurs through the interaction of environmental factors and the expression of genes.

In chickens, embryonic differentiation starts during egg formation and continues in the incubator. At the end of the second week of incubation, the embryo has almost reached its final size and shape.

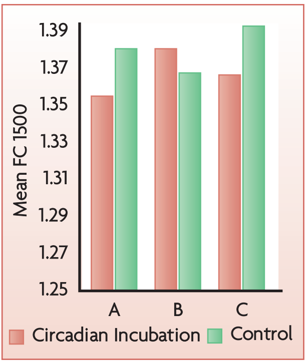


Fig. 1. Average FCR of broilers from three different breeder flocks. Four different Circadian Incubation cycles were performed in a large scale commercial single stage incubator. Experiments were performed at flock ages 35, 42, 48 and 56 respectively. For both Circadian and control incubation, the growth and feed consumption of 4,560 chicks were followed for 35 days.

The maturing embryo is sensitive to environmental stimuli such that physiological control systems can be trained or 'adapted', to cope with stressful environments for the long term.

It has been proven that incubation temperature influences the expression of genes involved in the maturation of body temperature control. Chronic, continuous temperatures that are too high or too low negatively affect maturation.

Conversely, short, daily temperature stimuli (Circadian Incubation) produce long lasting effects by training or 'imprinting' the thermoregulatory system – and it has been shown that training the thermoregulatory system during the maturation phase reduces the basic metabolic needs of the growing chicken. Temperature training induces a lowered body temperature at the thermoneutral zone – and thereby the amount of nutrient required to maintain the chick's body temperature.

Consequently, short daily temperature stimuli have a positive effect on economical parameters, such as hatchability, robustness, final bodyweight and feed conversion ratios.

Long lasting adaptation by Circadian Incubation only occurs if temperature stimuli are applied during critical, sensitive phases of development. In the chicken, this is during the final days of incubation, and further investigations are being carried out to define the optimum intensity and length of temperature stimulations for different egg types.

Circadian Incubation has already demonstrated positive affects on hatchability and feed conversion rates in commercial hatcheries and broiler farms, although interaction with breeder farms limits routine application.

Fig. 1 shows the variability in feed conversion rates in chicks hatched from eggs produced by different breeder farms. Future investigations will help to further understand the variable responses found in commercial practice.

Advice

- Optimise hatchery results using Circadian Incubation if single stage incubation practice is routine in your hatchery.
- Ensure accurate climate control in setters, to promote optimised temperature uniformity and sufficient cooling capacity that the incubation temperature can be reduced quickly and uniformly at the end of each temperature stimulus.
- Start Circadian Incubation on day 16.5 (two hours at 100°F set point) and continue through days 17.5-18.5 (one hour at 100°F) of incubation.
- Evaluate the results of Circadian Incubation in the hatchery and on the farm for each batch of eggs separately.
- Find the optimum length of temperature stimulation by undertaking trials on different batches of eggs of differing quality.
- Evaluate hatchability, chick quality and farm results after each trial of Circadian Incubation. ■

Tel: +31 314 659 111 • academy@pasreform.com

Future-focused hatchery construction

45

www.pasreform.com

By Sven Bulten, Project Engineer, Pas Reform Hatchery Technologies

Sustainability is an important feature of contemporary building design, often reflected in building regulations – and very achievable, given the many, varied material, design, energy and equipment solutions that are currently available. A hatchery building is made up of various construction layers, and therefore likely to use a combination of materials in the bearing structure, roof covering and façade cladding.

Selecting building materials

Early in the design process, materials are selected for each of these layers, based on their design, operating life, strength, appearance, fire safety, sustainability, speed of construction and cost.

Bearing structure

Various materials are suitable for the bearing structure. These include concrete, steel, wood and mixed construction materials. Steel is often chosen because it is sustainable and strong yet light-weight, and it offers variety and rapid construction speeds. Portal truss frames (with hinged column base joints and frameworks with hinged or wedged column bases) are highly recommended for the bearing structure. Portal frames possess adequate stability, requiring only perpendicular connections to deliver excellent stability and structural integrity. Where a larger span is required, truss beams are a good solution.

Roof covering

Minimal energy loss, to retain constant temperature and maximum climate control inside the building, is the aim when choosing a roof covering. Insulation, proper ventilation and the erection of the roof structure are important considerations when deciding on roofing materials, as is tolerance to natural, external stresses, such as snow, rain or wind.

Options for the roof covering include profile sheets with separate insulation sheets, steel roofing sheets with anti-condensation lining, corrugated fibre cement sheets, uninsulated roof panels and sandwich panels. Sandwich panels and profile sheeting with separate insulation are well suited for this purpose. These are fixed to the outside of the bearing structure, with the insulation sheets installed on the inside.

Façade cladding

Insulation and aesthetics are the two main considerations when choosing a façade cladding system. While masonry, prefabricated concrete panels and steel sheeting are often popular choices, steel cladding (sandwich panels) often yields the best results. Covering façades and roofs with the same panel types is not advised, as differences in slope and load mean differing requirements in detailing, fastening and joins. Ideally, façade panels are installed on the inside of the bearing structure, for ease of cleaning and hygiene. Take care to check the join between the façade cladding and the floor, to prevent the accumulation of dirt and water. Floor skirting may provide a good solution if this is a problem. Sandwich panels are often recommended for hatchery construction because they offer many advantages, including:

- Core materials and skins work together structurally.
- Sandwich panels are available in all forms and types of material.
- Prefabricated forms deliver short construction times and reduce costs.
- Both sides are finished.
- Outstanding structural characteristics.
- Can be assembled and disassembled in virtually all weather conditions.
- Hidden fastenings can be used to ensure that screw heads are invisible.
- Inherent rigidity means fewer fastening points.
- Extremely high thermal insulation.
- Lightweight.
- Large spans require minimal backing structure.
- Fire-resistant filling.

Advice

- Aim for simple structural design for the main bearing structure, with a limited number of components and joins.
- Expect good information on the choice of materials from the architect/construction company.
- Consider delivery times when choosing materials. Sandwich panels are manufactured to the required specification.
- Clad roofs and façades with different panels: using the same materials for both is not advised.
- Investigate the subsidies that may be available when using sustainable materials.

Tel: +31 314 659 111 • academy@pasreform.com

Brooding of chicks – a matter of care

46

www.pasreform.com

By Gerd de Lange, Senior Poultry Specialist, Pas Reform Hatchery Technologies

Good breeder and hatchery management, together with an optimised incubation process and transport conditions, will deliver a batch of good quality, uniform day old chicks. However, this alone is no guarantee of successful post-hatch performance. Of the many factors that have an impact on this, chick reception and brooding management are probably the most decisive. It is difficult to recover from a poor start during the first days, especially when, as is the case for broilers, the production period is short – or in the case of pullets, this will lead to a lack of uniformity.

Preparing the house for the chicks' arrival is an important aspect of brooding management. It is obvious that cleaning and disinfecting the house and equipment thoroughly between flocks is critical: scheduling the maximum number of production cycles a year should not ever compromise attention to proper cleaning and hygiene.

Perhaps not so obvious, is the benefit of allowing sufficient time to warm the house thoroughly, not only to warm the air, but also the floor underneath the litter. The floor should first be fully dried, with floor litter not being spread until a few hours prior to chick arrival, to promote a fast, uniform heat-up.

This attention to temperature in the house is essential, because the chicks' thermoregulatory systems are not yet fully matured. Their body temperatures largely depend on environmental temperature, and if attention is paid to the temperature of the air only, the chicks can still become undercooled if too much heat is transferred to a cold floor through their legs or body or when exposed to draught. Once undercooling has occurred, the chicks huddle, lie down and remain inactive instead of seeking water and food.

Making the house too warm is not only costly in most instances, but also leads to risk of dehydration as a result of panting, especially in combination with low relative humidity. Again, the chicks will become inactive, resulting in so called 'non-starters' and increased first week mortality.

Getting the chicks to drink and eat as soon as possible after arrival is a major target for the successful farm manager. Attention to detail in preparing the house, such as providing extra feed close to the drinkers (for example on special paper placed under the drinking nipple lines) or extra drinkers close to the feeders, and adjusting the level and pressure in the water lines, does pay dividends. In combination with a well-illuminated house, the chicks quickly find food and water.

Subsequently, checking the chicks' behaviour regularly – including body temperature and crop fill – allows for the observation of mistakes or oversights during those important first days in the broiler or rearing house.

Advice

- Clean and disinfect house and equipment thoroughly between flocks.
- Take sufficient time to warm the floor underneath the litter to 28-30°C/82.4-86.0°F prior to chick arrival. Depending on floor characteristics and starting temperature, allow 24-48 hours.
- Aim for an air temperature of 33-35°C/91.4-95.0°F at chick level depending on size of chicks (smaller chicks require a higher brooding temperature).
- Take chicks out of boxes immediately on arrival in the house, to avoid them becoming overheated.
- Start ventilation in good time to avoid high CO_2 concentration, while preventing draught, at chick level.
- Have fresh, clean water and feed easily accessible well distributed in the entire house.
- Ensure minimum light intensity of 20 Lux; 30-40 lux is recommended.
- Evaluate brooding management by regularly observing chick behaviour and take corrective actions immediately when necessary.
- Use seven day weight and first week mortality as key indicators for the quality of chick reception and brooding management. ■

Tel: +31 314 659 111 • academy@pasreform.com

Overcoming late mortality in Peking duck eggs

www.pasreform.com

By Marleen Boerjan, Director R&D, Pas Reform Academy

The incubation of Peking duck eggs is often thought more complicated than that of chicken eggs, primarily because of unfamiliarity with the specific properties of duck eggs that have an impact on incubation.

In duck incubation, the most common challenge is the high number of so-called 'drowned' or 'wet-embryos'. These embryos die during the fourth week of incubation as a result of insufficient water evaporation (= egg weight loss) from the eggs. Finally, fully grown duck embryos suffocate due to an inadequate supply of oxygen.

Duck eggs differ from chicken eggs in size and shell porosity. Peking duck eggs that weigh more than 100g are not exceptional. The porosity or conductance of the shell depends on the structure and density of the pores and shell thickness, including the cuticle. These features, the shell, porosity and cuticle depth of Peking duck eggs vary not only between flocks, but also within batches of eggs from a single flock.

The cuticle – thicker on duck eggs than on those of the chicken – is a waxy, protein-rich layer that covers the pores of the egg shell, limiting the diffusion of water (= weight loss) and the exchange of carbon dioxide and oxygen. In commercial duck incubation, variable cuticle thickness negatively influences hatchability.

To equalise shell conductance within a batch of eggs, the cuticle is often removed by washing the eggs in a hypochlorite solution. It is essential that this process thoroughly removes the cuticle from every egg, to avoid variation in the batch. This process increases the risk of excessive evaporation and thus dehydration, which is easily overcome by increasing relative humidity (RH) during incubation.

Egg shell conductance also increases during incubation, because the shell becomes thinner and the number of pores increase during mineralisation of the bones. The mobilisation of calcium carbonate from the inside of egg shell reduces shell thickness and frees pores previously blocked by calcium carbonate crystals. Increased conductance facilitates oxygen uptake by the late embryo.

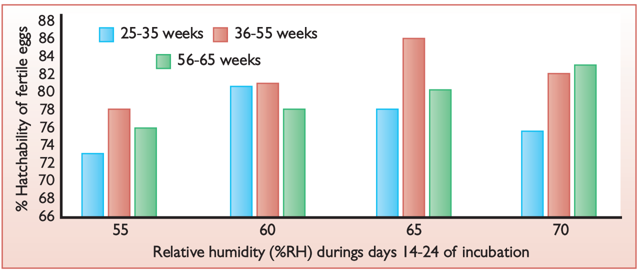
However, despite oxygen entering the eggs more easily, the variability between eggshell porosity and thus late mortality persists, as an intrinsic characteristic of duck eggs.

Late mortality can be reduced by using different incubation programs for different flock ages (El-Hanoun et al, 2012). The best recorded hatchability of fertile, unwashed eggs has been 60% RH for eggs from a young flock (25-35 weeks), 65% RH for a flock 36-55 weeks of age and 70% for the older flock (56-65 weeks) (Fig. 1).

Advice

- Store eggs at 13-15°C (55.5-59°F) and 75-80% relative humidity.
- Place eggs in a prewarming room 18-20°C (64.5-68.0°F) for at least 12 hours to avoid condensation (sweating) on the eggs.
- Equalise moisture loss between different batches by washing all eggs in sodium hypochlorite solution to remove the cuticle.
- Follow procedures for cuticle removal very accurately and carefully. Weight loss cannot be controlled if variable amounts of cuticle remain after washing.
- Porosity and thus weight loss depend on the level and uniformity of cuticle removal. When the cuticle is not completely removed and varies between and within batches of eggs, relative humidity (RH) set points may need adjustment between each incubation cycle.
- Adjust, per flock age, RH % set points during the last two weeks of incubation for the next cycle if egg analysis shows high late mortality. ■

Fig. 1. Unwashed duck eggs of specific flock ages require specific relative humidity (%) during incubation (El-Hanoun et al. (2012).



Tel: +31 314 659 111 • academy@pasreform.com

Do we understand 'hatch of fertile' correctly?

www.pasreform.com

By Gerd de Lange, Senior Poultry Specialist, Pas Reform Academy

Hatchability is commonly used to evaluate hatchery (and breeder flock) performance. Simply said, percentage hatchability = (number of chicks/number of hatching eggs) x 100. However, different interpretations of both the 'number of chicks' and 'number of hatching eggs', can cause confusion in hatchery performance accounting. Consider the following example:

A batch of 100 hatching eggs produces 87 day-old-chicks (see table). Hatchability of eggs set is (87/100) x 100 = 87.0%. However, if one of these 87 chicks is of second class quality, it is logical to base percentage hatchability on saleable chicks only: (86/100) x 100 = 86.0%

Evaluating true hatchery performance by calculating hatchability of fertile eggs ('hatch of fertile') is widely accepted. This makes sense, because no skill, expertise or technology can hatch chicks from infertile eggs.

Returning to the example: eggs are candled before transfer and nine 'clears' recognised and removed. It is not uncommon to calculate hatch of fertile based on the number of transferred eggs: (86/(100-9)) x 100 = 94.5%. It is unlikely that all nine clears are actually infertile – and performing an egg break-out on the clear eggs will establish true fertility.

Suppose of those nine eggs, five are infertile and four show embryos that died during the first week of incubation. This brings real fertility to 95.0%. By this method, the correctly calculated hatch of fertile is not 94.5%, but (86/(100-5)) x 100 = 90.5%: a very significant difference of 4% – simply as a result of defining 'fertile eggs' differently.

The question is, on which calculation method is the generally accepted standard for good hatchery performance of 95% hatch of fertile based? When, incorrectly, clears determined by standard candling procedures are the basis for the calculation, it is easier to achieve this standard.

However, mostly some of the clears are fertilised eggs that contain a dead embryo. A better definition for the result of this calculation is 'hatch of transfer'.

'Hatch of transfer' also depends on accuracy of candling. Imagine in the above example, with precise candling, one additional 'clear', a mid term mortality, was revealed.

Hatch of transfer then increases one percent to (86/(100-10) x 100 = 95.5%, although this does not actually mean that hatchery performance is better!

To achieve 95% 'hatch of (true) fertile', 90 saleable chicks should hatch from the 100 eggs set – and with five infertile eggs, only five hatching eggs may be lost due to early, mid or late embryonic mortality.

Hatch of transfer = (saleable chicks/number of transfered eggs) x 100
Hatch of fertile = (saleable chicks/number of true fertile eggs) x 100

Calculating hatch of fertile in daily hatchery practice is challenging, and complicated by the need for correct procedures to accurately estimate true fertility. Just candling is not enough. Early dead embryos during the first days of incubation are incorrectly counted as infertile eggs – and candling equipment's ability to recognise true infertile eggs depends on accurately calibrating sensors and software.

Advice

- Interpret hatchability data only when the method of calculation is known.
- Base hatchability calculations on saleable chicks rather than total chicks hatched.
- Use 'hatch of fertile' to better understand true hatchery performance.
- Perform a hatching egg break out on a representative number of clears, preferably obtained during 10 day candling, to estimate true fertility.
- Use 'hatch of transfer' if there is no procedure to estimate true fertility.
- Continue to seek improvement even when 'hatch of transfer' is over 95%, if early mortality is high. ■

Eggs set	'Clears'			1st class chicks	2nd class chicks	Total chicks
100	9			86	1	87
	Infertile	Early dead	Mid dead			
	5	4	1			

Tel: +31 314 659 111 • academy@pasreform.com