Fertile or not?

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by Maciej Kolanczyk, Senior Hatchery Specialist, Pas Reform Academy

Fertilisation marks the beginning of a new life but is by no means a guarantee of a long life, as the journey is full of obstacles. Stress, genetic factors, diseases or nutritional deficiencies may all kill the embryo before the egg is laid.

The newly laid egg is then exposed to another set of risks: the conditions under which it cools down from the hen's body temperature to the ambient conditions in the nest, the time this takes, mechanical factors, chemicals, infections and even disinfection are all hurdles to overcome. After that comes storage, transport and the start of incubation – not always conducive to survival.

These kinds of very early mortality are almost impossible to identify in a standard, industrial way – by candling. As a consequence, the 'clears' category contains both eggs that are truly infertile and those that contain early-dead embryos. The only way to distinguish truly infertile from early-dead eggs is by breaking them out for analysis. However, to diagnose accurately and thus choose the correct solution, it is essential to be able to distinguish between these two groups.

The presence of a tiny ring on the surface of the yolk, just 3-4mm in diameter – visible immediately after oviposition – allows the egg to be classified as fertilised. The embryo continues to develop as the egg cools down. During an optimum cooling time – six hours – it will grow to a diameter of about 5mm and become storage resistant. This is stage XII-XIII, when the ring is still small and its centre is clearly yellow.

The colour of the yolk surrounding the embryo remains unchanged. Too slow cooling, or high storage or transport temperatures cause the embryo to develop more. An increased diameter of the ring, its centre filled up with white cells, and a pale yolk zone surrounding the embryo indicate continued development and absorption of water from the albumen. These embryos have developed beyond the storage-resistant stage and will probably die if placed in the low temperatures used for storage.

Life continues, and the start of incubation brings further changes. After just 24 hours, the pale-yellow yolk zone surrounds the embryo. After 48 hours, that zone has increased, and a small island of blood vessels can be seen with a magnifying glass or under the microscope. By 60 hours, the vessels have developed and soon a blood ring can be seen with the naked eye.

The development of the vessels is a reliable indication that the egg is fertile. But be careful: traces of blood found in an egg that has not been incubated are not necessarily a reliable sign of 'life'. Meat or blood spots – released in the hen's oviduct – can be found even in infertile table eggs.

Analysis of 'clears', done by candling at 7-10 days, provides reliable information. Candling earlier than this makes no sense. Changes in yolk colour, or cloudy yolk in an apparently 'clear egg' can be interpreted as an expression of very early mortality.

The more advanced phases such as 'blood ring' or 'black eye' leave no doubts. If a break-out is done later on – for example at transfer – indicators of very early mortality are less visible and mistakes are easier to make, as the yolk membrane becomes weak and breaks easily.

Advice:

- Practice distinguishing between 'fertile or not' on fresh eggs that have not yet been incubated.
- Check the stage of embryo development by measuring diameter and assessing appearance when eggs arrive. Use this information to decide on cooling, on-farm storage and transport.
- If % of 'clears' is cause for doubt, shift candling to days 7-10 to get a clearer picture.

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Navel practicalities 97

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A well-closed navel is one of the most important and easily visible signs of chick quality. In a good quality chick, the navel is well hidden in the down. One needs to blow to see it. Running a finger over it, you will hardly feel it – it is smooth and dry. It is light coloured, similar to the surrounding skin. These qualities are not always found, however. Even chicks hatched from eggs incubated under excellent conditions may still have poor navels.

A chick's navel is the residue of the entrance through which first the small intestine and then the yolk are absorbed into the body cavity. Absorption begins on day 17 and continues until day 20, making these three days critically important. The closure of the navel requires optimal synchrony between the embryo's physiology and the development of the morphological structures. Chicks hatched from long-stored eggs or from eggs produced by older breeders often show poor navels, which is probably due to disturbed synchrony.

The closure of the navel is a process that requires time and a stable, comfortable environment. Any interfering factors, such as too high or too low temperature or poor ventilation, should be avoided. These are an indication of the importance of conditions at transfer and in the hatcher.

However, other factors may cause poor navel quality too. If there is insufficient water loss during incubation, the belly will be too full to absorb everything and too stretched for the navel to be able to close. Suboptimal incubation conditions (for example chronically too low, or too high temperature) reduce utilisation of the yolk sac, as a small, underdeveloped embryo is not able to absorb the big yolk residues.

A similar problem arises if the chicks are pulled out too early or if the hatch window is very large. Late hatching chicks will simply not have enough time to close their navels.

A leaking, wet navel that is not properly closed behaves like an open wound, and is a potential place for bacteria to enter the most sensitive part of the body cavity. Just 'behind the walls' lie internal organs and the residues of the yolk sac, providing perfect conditions for bacteria to breed, which can result in mortality in the first week of life! A dry, rough navel that looks like a dark button, or the dried remains of the umbilical cord still attached, are of course also undesirable, but less risky.

Forming the navel is the finishing touch of the long process of incubation; think of it as a 'cockade on the gift package' If the person making it is preoccupied, in a hurry or disturbed – or if the package is too big or the ribbon too short – the final effect will be disappointing. So make sure the embryo feels comfortable.

Advice:

- Treat navel quality as the basic trait that expresses chicken quality.
- If you notice a high frequency of poor navel quality, check conditions of the late setter phase and in the hatcher.
- Support maximum utilisation of the yolk sac by avoiding chronically too low or too high temperatures in the setter. Fully developed embryos with little yolk residue will have no problem closing their navels.
- Avoid high temperatures in the hatcher phase, as this can make the navel close too fast before the yolk sac has been fully absorbed.
- Optimise hatcher ventilation with respect to CO_2 and relative humidity.
- Monitor the relationship between the navel and belly status. If you notice full bellies combined with badly closed navels, adjust the rate of weight loss during incubation.
- Aim for a narrow hatch window by ensuring good preheating and uniform incubation conditions.

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Antibiotic-free (ABF) production 98

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In the hatchery itself there is never a direct reason to apply antibiotics, as the chicks do not stay here for any length of time. If antibiotics are applied (in-ovo or by injection after hatch) this is done preventively to avoid disease problems or for potential benefits at the farm where the day-old-chicks will be delivered. Furthermore, on the farm itself antibiotics can be administered by feed or drinking water as a preventive measure or as a growth promoter. This way of using antibiotics is coming under increasing criticism, as it leads to antimicrobial resistance (AMR), which means that bacteria might eventually become resistant to antibiotics. In the long run this causes problems for the treatment of diseases in humans and animals.

Many modern poultry companies now aim to produce without using antibiotics, or at least to limit their use to therapeutic purposes only.

Some countries have introduced legislation outlawing the use of antibiotics both as a preventive measure and as a growth promoter; in other countries companies are responding to consumer demands for 'safe and clean' food.

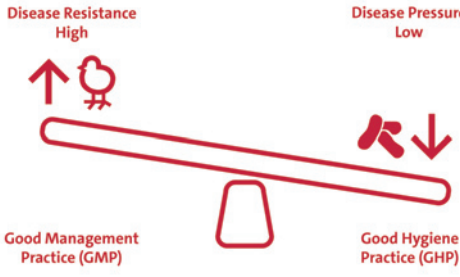
The question now is what role hatcheries could play in helping to stop the preventive use of antibiotics and to reduce the need for therapeutic use. This is clearly visualised in the figure below. Poultry, for example a broiler flock, will stay healthy if the following two conditions are met:

- High disease resistance, so the animals are robust and have a high level of immunity.
- Low disease pressure, so pathogens (bacteria, viruses) are absent or only present at very low concentrations.

Under these conditions there is no need to apply antibiotics and the broiler flock will potentially perform very well. However, if disease resistance is low and/or disease pressure high, problems are likely to occur on the broiler farm. In this case it is tempting to use antibiotics preventively, as otherwise it is more likely that they will have to be used therapeutically in the event of problems such as increased mortality.

Advice

- Deliver day-old-chicks with high disease resistance by applying Good Management Practices on the breeder farm and in the hatchery. These include:
  - Provide optimal incubation conditions to ensure strong and vital day-old chicks (with a well-closed navel and well-absorbed yolk sac).
  - Apply a good vaccination programme on the breeder farm or broiler farm and in the hatchery to ensure a high level of immunity.
  - Avoid stress factors for embryos and chicks, such as overheating, chilling, dehydration and delayed feed access.
- Keep disease pressure in the hatchery low through Good Hygiene Practices:
  - Implement biosecurity measures to prevent pathogens from entering the hatchery; this includes good egg hygiene.
  - Avoid cross-contamination to prevent transport of pathogens within the hatchery.
  - Clean and disinfect regularly to prevent further development of pathogens in the hatchery.



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Early embryonic death 99

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The act of fertilisation – which takes place just after ovulation, at the entrance to the oviduct – is the beginning of a new life. From that moment this 'life' has two options: to continue or to die.

As the embryo consists of live cells, the same fate applies to them. Cells can keep on dividing and differentiating (to form different organs and tissues), or – if conditions become unfavourable – they may die.

At the moment an egg is laid, the embryo already consists of 30-60,000 cells. The death of some of them – for example under extended or suboptimal storage conditions – does not necessarily mean the death of the entire embryo. Well-organised, periodical heat treatments during egg storage can help to rebuild deteriorating structures and prolong the embryo's viability.

Assuming the egg was fertilised, the embryo may die before incubation starts or during that process. A sharp distinction is not always made between these two phases, but this must be done if the cause of the problem is to be identified. A break-out of 'clears' can help to answer the question "When did the embryo die: before or during incubation?"

Eggs, whether they hatch in the wild or in captivity, must wait until incubation begins, and during that time the embryos remain in diapause (suspended development).

An embryo is a delicate structure, which is very susceptible to damage. The germ quality is affected by many biological factors including genetics, health status of the breeder flock, nutrition, hygiene, cooling after laying, and stress. Mortality before setting can result from physical impacts such as mechanical shocks, rapid changes in temperature, dehydration, infections and chemicals.

Breeder farm related factors such as method and frequency of egg collection, method of egg cooling after oviposition, quality and stability of environment during storage and transport all play a role. Therefore, the hatching egg must be treated as a living, delicate organism. Rough handling, excessive disinfection, rapid and large changes in environmental conditions should be avoided.

The start of incubation is a new challenge. The clear phases of embryo development during the first days of incubation make it possible to accurately pinpoint the moment of mortality. The temperature is actually the only factor that counts at this moment. Cell division and differentiation start at about 82°F (28°C). An embryo temperature of above 105°F (almost 41°C) – if this lasts for too long – will have a lethal effect. An embryo temperature of about 100°F (38°C) is assumed to be optimal.

Early embryonic death, even if it occurs during the first days of incubation, can usually be ascribed to problems before the actual start of incubation. However, thermal conditions during early incubation itself may also play a role, such as an incorrect setpoint, too slow or too fast heating-up or poor uniformity caused by the inconsistent workings of equipment or those operating it.

Advice

- Treat the hatching eggs as living organisms.
- Analyse the factors that determine egg quality before setting: status of breeder flock, egg collection, disinfection, transport and storage.
- Consider applying a heat treatment and turning during prolonged storage.
- Break out some eggs to check the status of germs before setting. Identify the true infertile eggs.
- To verify the level of fertility and early mortality, check eggs by break-out during the early incubation phase (7-10 days).
- Ensure correct temperature setpoints at start of incubation and keep the machine closed to avoid cold and hot spots forming.

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Air pressure in the hatchery 100

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The hatchery is where we create the optimum conditions for life to develop. Although we are talking about the development of embryos, there are many other – unwanted – forms of life, like fungi and bacteria, which can also take advantage of these conditions in the hatchery. That makes hygiene an important concern.

It is relatively easy to create sanitary barriers on the floor of a hatchery. Air, however, is a difficult carrier to control. The air pressure system in the hatchery was originally created as a hygiene measure. Contamination in the hatchery progresses in tandem with the incubation process: setting = 'clean', hatch = 'dirty'. That makes the parts of the building easy to define. Air should move consistently in one direction – from 'clean' to 'dirty'. That is logical, and it sounds easy – but it is not.

Forcing the air to go in one direction requires a system of devices that measure and control the air pressure, so that it goes from high in the 'clean' part to lower in the 'dirty' part. The hatchery building is a complex construction, with many obstacles and opportunities for leakages. To make the system work requires a certain amount of discipline, so that the air is forced to move as planned. In addition, fresh air, preconditioned by the Air Handling Units, is a costly product and must be used economically.

The pressure differences are not only of hygienic value. The difference in air pressure between the incubator air inlet and the outlet supports the ventilation rate in the machine. But more does not necessarily mean better. The air supply must be balanced by an adequate air exhaust.

A too high pressure difference may create a short-cut in the air circuit. Air will take the easiest way from the inlet to the exhaust and leave dead spots elsewhere – causing poor uniformity of temperature and ventilation. The balance – an equilibrium between supply and removal – has a dynamic character.

Demand for air exchange fluctuates, depending on the phase of the incubation cycle and volume of the load. The hatchery's air pressure control system must be reactive and flexible. The air supply demand for the entire installation also changes depending on the number of machines in use.

The measurements of air pressure at supply and exhaust are relative values. To measure them we use a reference: the external air pressure. This is measured by sensors located outdoors, where they are potentially exposed to the wind. It is essential to make sure that this reference is reliable, so it is very important to ensure that the reference sensors are correctly located and protected.

Advice

- Make sure the air flow in the building is in line with the concept.
- Always keep all doors and windows closed.
- Control the status of fans used to maintain the pressure system in the building.
- Pay attention to the technical status of Air Handling Units. Control their filters, heating and cooling coils and motors.
- Maintain the incubator's inlet and exhaust pressures as recommended by the machine manufacturer.
- Make sure the incubators are well sealed and that no air escapes though the dampers of machines that are not in use.
- Install the reference pressure sensors so that they are out of the direct influence of the wind.
- In case of doubt, check the distribution of egg shell temperatures in the incubators and the hatch result in different parts of the hatcher. An increased spread may be an indication of an incorrect pressure ratio between inlet and exhaust.

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18-day egg transport 101

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On-farm hatching is now fairly common in some countries. It requires eggs to be transported from the hatchery to the farm at 18.0-18.5 days of incubation and they must arrive on the farm before external pipping starts. The embryos need to be kept vital during transport to ensure a good hatch on the farm. The eggs must have sufficient oxygen; shocks and jolts must be minimised; and the temperature must be controlled.

This raises the question whether we can simply apply the same set point temperature in the truck as in the hatcher, which is approx. 36°C (97°F). We could indeed do this if air speed over the eggs were similar, but we can assume this will not be the case. In the temperature-controlled truck, depending on its design, air speed will be lower, as will be the uniformity of air speed.

18-day old embryos produce approximately 170-180 Watt of heat per 1,000 eggs. To avoid embryo temperature becoming too high, this heat has to be removed by circulating cooler air. Fig. 1 shows that the lower the air speed over an individual egg (for example 0.5m/sec as opposed to 2.0m/sec), the greater the difference between the temperature of the egg shell and that of the circulating air. In other words, at a constant air temperature, eggs exposed to a lower air speed will be warmer than eggs exposed to a higher air speed.

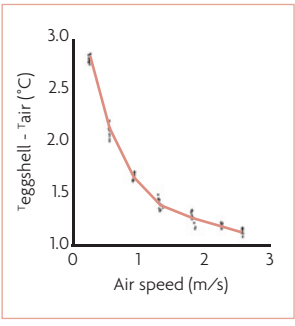
Moreover, air speed will not be the same over all eggs in the load. The figure also shows that the uniformity of egg shell temperature will be more negatively affected by variation of air speed in the lower air speed range. To make matters worse, it is most likely that the air flowing over the eggs will not be at a constant temperature, especially when air speed is low, and as a result hot spots are likely to develop.

Generally, the following statements apply during transport of 18-day incubated eggs:

- Overheating (some) eggs does greater harm than cooling (some) eggs to below optimum temperature; overheating can kill the embryo or affect the quality of the day-old chicks, whereas temporary undercooling only slows down the hatch, which might actually be an advantage over longer transport distances.
- The lower the air speed over the eggs, the lower the temperature in the truck should be.
- The greater the variation in air speed over the eggs, the lower the temperature in the truck should be, in order to avoid a few eggs in an area with low air speed becoming overheated.

Note, however, that air speed over the eggs depends not only on truck design, but also on how the eggs are transported. Eggs on setter trays in spacious trolleys can be transported at a higher temperature than eggs that are tightly packed together.

Fig. 1. The difference between egg shell and air temperature at different air speeds and constant air temperature (Van Brecht et al 2005).



Advice

- Apply a lower air temperature for transporting 18-day incubated eggs than you would do in the hatcher; temperatures typically used in practice are between 25-32°C (77-90°F).
- Be aware that the air close to the sensor in the body of the truck is likely to be cooler than the air between the eggs.
- Monitor egg shell temperature during transport and adjust air temperature accordingly.
- Bear in mind that aiming for an egg shell temperature of 100°F carries the risk of some eggs becoming too warm due to lower uniformity; a safe range between too cold and too warm is 90-96°F.

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Optimising multistage incubation

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On the face of it, multistage incubation is an easy procedure. The setter is loaded with a new batch of eggs as the oldest batch in the setter reaches the point of needing to be transferred. A fully loaded machine contains eggs at all stages of incubation, and the average incubation age will be about nine days. At this stage in a single-stage incubation programme, the eggs do not produce a lot of heat and their oxygen demand is limited.

Multistage incubation does not present great technological challenges. The setter can work at constant, fixed settings, aiming to create acceptable conditions for all batches. The trouble is that this 'average load' consists of batches that are in very different phases of incubation: from eggs that have just been loaded to eggs about to be transferred.

The average set points might be close to the optimum for the middle groups, but they will be far from optimum for the extremes. And it is the extremes that determine the results. Too low a temperature at the beginning will cause an increase in early embryonic death. Overheating during the last days will lead to late mortality and poor chick quality.

The eggs themselves offer a solution, however. Their opposing requirements can be utilised for mutual benefit. Fresh eggs are cool when loaded and need to be heated. Eggs containing advanced embryos must be cooled. Placing these two groups next to each other creates an opportunity for mutual heat exchange.

Although all incubator manufacturers claim that their machines create a very uniform environment, breaking the laws of physics is not that easy. Differences in air speed, distance to the coolers, heaters, humidifiers and air inlets matter, and are reflected in egg shell temperature. Cooler and warmer zones can be defined in all types of equipment, and this can be made use of in a multistage system by placing the egg batches accordingly.

Temperature is of course not the only important parameter. Selection of the correct humidity setting, in line with the local egg shell quality, is critical for achieving 11-13% weight loss.

Typically, the standard settings for a multistage incubator are: T 99.5°F, RH 50%, valve 50% (or CO_2 0.4%). The value of the parameters can vary quite widely, however. For example, optimum temperature can range from 99.0-99.9°F.

So, how to select the optimum setting? The advice will depend on local measurements and observations, which must be carried out routinely: measuring egg shell temperature, calculating egg weight loss, and monitoring the machine's behaviour.

In a smoothly working incubator, internal devices will show low activity, the machine appearing to do nothing. Loading a new batch of eggs will activate heating, but this will stabilise again within a few hours.

Overheating presents a higher risk than slightly too low temperatures. Egg shell temperature between 99.4 and 99.7°F will slow down the process, while a temperature above 102.0°F poses a risk.

Advice

- Define the cooler and warmer parts of the setter, specific to the equipment type.
- Load the fresh eggs accordingly and place them next to the older eggs.
- Prewarm the eggs before loading (for at least 12 hours at 25-26°C) to mitigate the resulting drop of temperature.
- Avoid egg shell temperatures below 99.0°F and above 102.0°F.
- Check egg weight loss to select the RH setpoint.
- Select the maximum valve position within the 30-60% range at which the machine remains stable. Opening too wide activates the humidifiers, which is undesirable, and opening too little can cause too high CO_2 levels.

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Incubating duck and goose eggs

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There are relatively few hatcheries that specialise in waterfowl. Their programmes and procedures are largely based on traditions and many years of practical local experience.

Usually, people try to mimic Mother Nature. Waterfowl nest close to water, and a brooding female returns to the nest from the water wet and chilled. It would seem that these conditions help hatchability, as it is rare to find an unhatched egg in the nests of wild ducks or geese.

As a result, spraying eggs during incubation became a standard procedure. This begins somewhere between day 10 and 14, and is continued until the eggs are transferred. Trolleys must be moved out of the setter; the eggs are sprayed with lukewarm or cold water and then returned to the setter. In a multistage setter, the effect on the other eggs in the machine is only temporary. A single-stage machine needs much more time for the settings to be restored.

Generally, two types of trays are in use: plastic trays, where the eggs stand upright, and metal-wire trays where the eggs lie flat or are half-tilted. Some goose hatcheries claim that combining spraying with turning the eggs manually an extra time each day along their long axis also has a positive impact. However, this requires a lot of manual work, which can be a problem as hatcheries are getting bigger and labour costs higher.

Not surprisingly, the waterfowl branch is looking for shortcuts. The fundamental questions are: what is the actual effect of the spraying? Does it simply cool the eggs down? Or does it have another function? And is it necessary?

Waterfowl eggs differ physically from hen eggs. To cope with the humid environment, they have a strong waxy coating – a cuticle. This coating protects them from infections. However, this 'tight packing' impedes the exchange of gases and evaporation of water. Its structure must become open early enough to provide the growing embryo with sufficient oxygen and create an air cell big enough to facilitate hatching.

We can override nature by removing the cuticle in advance. This can be done by washing the eggs with a sodium hypochlorite solution in a specialised washer under strictly controlled conditions. However, washing makes the 'naked' eggs much more vulnerable to infections.

Hygiene in the hatchery therefore needs to be perfect and should include early removal of 'clears' and early deads, absorption of contaminated air at transfer, and good control of fluff at hatch. These extra requirements are balanced by the elimination of spraying and make incubation of waterfowl eggs as simple as for chicken eggs.

Another possible option – used by some hatcheries – is a single-stage incubation, where setter inlets, outlets and door are fully sealed for the first 14-17 days. Eggs must be clean, fresh and good quality, but not disinfected.

As long as the ventilation remains closed, humidity stays at 80% or higher, and the CO_2 concentration can rise as high as 1%. No spraying is practised later on. Although not very common, this system leads to surprisingly good hatch results.

Conclusions

- The main problem when incubating waterfowl eggs is controlling cuticle status. The cuticle can be gradually destroyed by spraying, creating specific microclimate conditions, or removed by using a chemical wash.
- The cooling effect of spraying is most likely not relevant. Chemically washed eggs hatch well without spraying.
- Microflora apparently play an important role in destroying the cuticle. Spraying seems to help microflora to 'consume' the cuticle.
- Tray type, egg position, and manual turning along the long axis (to reach all sides of the egg) only matter if spraying is done.

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Different incubation profiles

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Breeding has powerful effects. Although all chicken breeds originate from the same wild ancestor, they differ dramatically in appearance, physiology, type and metabolic rate. Surprisingly though, one detail remains fairly constant: the incubation time. Whether for a lightweight laying hen or a solid yield broiler, it is very close to 21 days. Comparing incubation requirements, we see similarities and differences. The most impressive similarity is the optimal temperature for embryo development: close to 100°F. And that is not only for chickens but also for other types of poultry.

Embryo temperature – usually checked by measuring the temperature of the eggshell and called EST – initially depends entirely on the environmental temperature. Later on, after day 10, the embryo begins to produce heat and then the EST depends on the balance between heat production and the opportunities to get rid of the surplus. This is where breeds can differ widely. Chicken breeds are highly specialised. Layers and broilers have very different body constitutions, like sprinters and heavyweight boxers.

A layer – also as the parent stock – is a champion egg layer. It must be light and cheap to maintain – and produce eggs with very strong shells for protection. Broiler breeds are just the opposite: they need to have a healthy appetite and be able to convert big quantities of feed efficiently into body mass.

Quality of eggshell is much less important for them. These rough characteristics determine the differences in appropriate incubation programmes.

Some differences apply to the entire incubation period, others do not. Eggshell quality is an example of a durable difference. Due to long-term intentional genetic selection, layer embryos are 'better packed' in a strong, thick shell, which can have an impact on egg weight loss during incubation and creates a bigger mechanical problem at hatch.

A broiler eggshell is weaker from the beginning. The French research institute INRA announced recently that they will further test the hypothesis that the thick-boned broiler embryo probably absorbs more minerals from the shell, making the latter even thinner before hatch. Chicken types' metabolic rates vary, resulting in different embryonal heat production. This must be compensated for by applying different temperature set points during incubation.

Incubation is to a large extent (although not exclusively) a problem of controlling two main factors: temperature and egg weight loss, and these are issues for both types of breeds. Deviation from an optimum affects results in both types, although high heat production makes broilers particularly vulnerable to the problems related to overheating. The incubation programmes for these two types of poultry will be identical for the first 10 days of the programme. The embryos still do not know their 'profession'. After day 9-10, broiler eggs require lower temperatures, not only in the setter but also in the hatcher.

Of course, there are many different varieties of both broilers and layers. In addition, some contemporary breeds are known for their specific preferences; for example, some layer strains prefer low, broiler-like temperature profiles.

Advice

- Base the set points of the incubation programme on the actual response of the eggs: measured EST and egg weight loss.
- Closely monitor the EST after day 10. Try to keep the values within a range of 100-101.5°F.
- Keep in mind that eggshell quality is a breed-related trait. Allow sufficient time and maintain correct RH settings to reach a final weight loss of 11-13%.
- Analyse your patterns of embryo mortality and chicken quality to fine-tune the programme.
- Do not stick to standards. Adjust your profiles to the specific requirements of the local breed.

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