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Broiler Breeder effects on Incubation and Hatchlings

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Hatchery managers will comment (often with some bitterness) that the effectiveness of their work in the hatchery to optimise hatchability and chick quality is constrained by actions taken long before the eggs reach the hatchery.

- **Breed and farm management decisions** can have a **profound effect** on how eggs and the embryos they contain perform in the hatchery.
- However, if the hatchery manager is **alert to possible changes,** and understands the **essentials of incubation then it should be possible to take considered decisions concerning the best way to manage the eggs that are delivered.**

To optimise hatchability and chick quality, the incubation process must deliver certain key targets:

- Embryo **temperature should be a constant 100°F** (37.8°C) from set to hatch (E0 to E21), the moisture loss to **E18 should be 10.5-12.5% and chick yield at take-off should be 67-68%.**

- In addition, **eggs should be turned through 90o once an hour from E0 to at least E16 and the incubator should be ventilated sufficiently to control the build-up of CO_2,** and allow the embryo sufficient oxygen.

- Hatchling quality may be damaged if the **eggs are contaminated,** if the hatch time is **shorter or longer than expected or the hatch spread is too wide.**

- Incubation temperatures which deliver embryo temperatures outside the optimum will **damage normal development.**

These incubation targets apply to all breeds and generations of domestic fowl, whether bred for egg or meat production. However, **differences in genetics, health, nutrition and egg management can often affect the inputs and incubation settings needed to achieve these targets.**

The need for uniform egg and yolk weight, for sound eggshell quality, for good albumen quality and yolk strength, coupled with a need for the eggs to be naturally clean and effectively disinfected are all factors which can be altered by management decisions made on both rearing and laying farms.

The list of contributory factors is long and includes aspects of:

- Breed choice
- Flock age
- Flock uniformity at point of lay and through the laying cycle
- Nest management and hygiene and egg collection frequency
- Hatching egg selection, cleaning and disinfection
- Egg storage conditions
- Egg transport conditions

To get the best performance, the farm and hatchery need to communicate and cooperate, and the hatchery manager must be permitted to make active, if infrequent, adjustments to incubation settings to take account of changes in eggshell conductance, egg size and incubation time.

Breed Choice

Broiler breeder crosses will **vary in their egg shell conductance** (a measure of how fast gases such as oxygen and water vapour can pass through the egg shell).

- The differences are usually small, and it only when comparing the needs of a meat *vs.* an egg layer cross that it might be sufficient to require action.
- In this case it would probably **be necessary to drop the humidity in the setter to correct for low water loss in a layer breed that has been selected strongly for shell strength.**

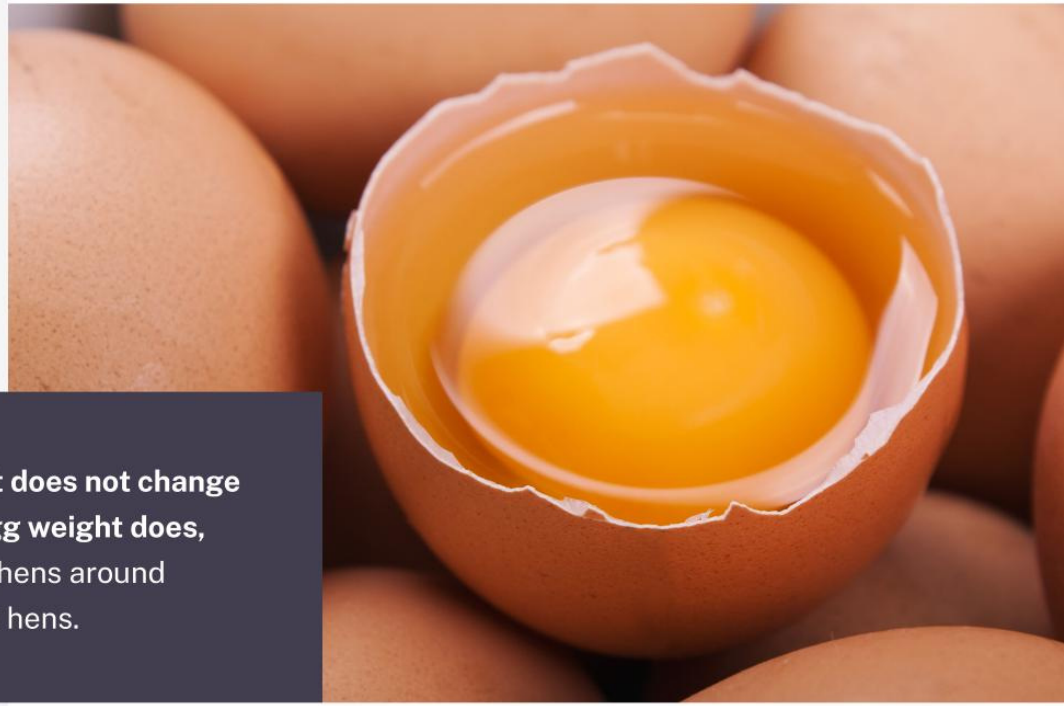
Although high conductance tends to be associated with thinner shells, **there are advantages to having effective gas exchange,** in that the embryo will be more likely to have plenty of oxygen later in incubation when it needs it.

An important variable is hatch time:

- Internal trials over the last 18 years at Aviagen have shown that Ross 708 eggs hatch faster than Ross 308 by about 6 hours.
- Cobb 500ff eggs tend to take about the same amount of time as Ross 708.
- Ross 308AP are slower than Ross 308, by a further 4-5 hours.
- So, if changing from Ross 708 to Ross 308 it is important to set the eggs earlier, to allow all the chicks have enough time to hatch and dry out before take-off.
- Conversely, if changing from 308 to 708, eggs need to be set later, to avoid having fully mature chicks left in the hatcher for longer than is necessary.
- In eggs of the same weight, Ross embryos generate slightly more heat than Cobb ones *(Nangsuay et al 2015)*, possibly because of their higher shell conductance.
- However, the difference in heat output is very small, considerably less that that seen between small and large eggs *(Lourens et al 2006)*.

Flock Age

As a flock gets older, the rate of lay gets less and egg size increases.



Chick weight as a percentage of egg weight at set does not change with flock age, but yolk size as a percentage of egg weight does, starting at around 25% of eggs laid by very young hens around 26 weeks, rising to 31% in eggs laid by 51 week old hens.

Embryos in large eggs produce more embryo heat per egg, than those in small eggs. This must be taken into account when planning the placement of eggs in the setters, to make sure that each setter is, as far as possible, balanced for heat production.

Flock Uniformity

Much of the skill in managing broiler breeder flocks during rear is in **keeping the population as uniform as possible.**

In an *uneven flock,* the pullets will not reach sexual maturity all together, and as a result egg size will be variable from the start. Large eggs take longer to reach incubation temperature than small ones and batches of eggs with a wide variance in egg weight will have a wider hatch spread as a result.

Flocks which are very uneven in their sexual maturity, will also have less uniform yolk size, where the later maturing pullets will still be producing eggs with relatively low yolk when the earlier maturing ones have a higher percentage yolk.

Nest and Egg Collection Management

Nest linings **must be kept clean and free of droppings on a daily basis** – eggs laid onto dirt will become contaminated very quickly due to the lack of protection from the immature cuticle.

Once it is completely cured, several minutes after the egg is laid, even wet droppings are less likely to cause contamination.

- **Frequent egg collections (4 to 5 per day) minimise the amount of bacterial contamination.** Frequent collections will also ensure that egg cooling is consistent across the egg pack, which will help to limit the hatch spread.

- However, it is also important that all the eggs are allowed to cool properly before they are packed in crates or cardboard boxes. If this is not done, eggs in the middle of the box will cool much more slowly than those at the edges, making the hatch spread much more uneven.

Hatching egg selection, cleaning and disinfection

During egg collection, **the eggs need to be sorted, removing any which are soiled, damaged or abnormal** (e.g. double yolks, slab sided, poor shell quality). Small specs of dirt can be removed, but **the use of abrasives or cloths to clean the egg surface should be avoided.**

Badly soiled eggs should not be set, because the microbial contamination will not only harm hatch and chick quality of the eggs directly affected, but also that of other eggs in the same machine when contaminated eggs explode in the incubator.

Selected hatching eggs should be packed, small end down, onto setter trays, which are then placed in a farm buggy, stacking from the bottom upwards to avoid rewarming eggs when eggs from a later collection in the same day are added to the same stack (because heat rises).

The eggs should be disinfected as soon as possible after collection, which will reduce the chance of bacteria or fungi passing through the shell pores.

- The *disinfection method* of choice should be an effective shell surface disinfectant, without damaging the dormant embryo.

- It must also **not damage the cuticle** – physical abrasion, harsh spraying and corrosive chemicals can all cause problems, particularly with repeat applications.

- Formalin gas used to be the fumigant of choice, and is still very hard to match. Unfortunately, it is a carcinogen at low exposure levels, and as such it is difficult to justify using on farms. Many operations compromise, using a safer option on farm (usually fogging with peracetic acid or ultra violet light exposure) and then formalin fumigation on arrival at the hatchery. Note that repeated application of peracetic acid will cause cuticle damage.

Egg storage conditions

While the fertilised blastoderm is in the oviduct, embryogenesis continues, with most chicken embryos being between EKG stages IX and X at the time of lay *(Eyal-Giladi and Kochav, 1976).*

Egg storage on the farm should aim to cool the eggs sufficiently to stop embryo development and maintain internal egg quality.

In practice a storage **temperature of 15°C is low enough to stop all embryo development and maintain albumen quality,** without being so cold that condensation on the egg shell surface is unavoidable when the eggs are moved from farm to hatchery.

Farm egg stores should be designed to *cope with local climatic conditions,* with good insulation and sufficient heating and cooling capacity to cope with local extremes. The door should remain closed unless in active use. There is more information on egg storage in a later lecture.

Egg transport conditions

Eggs should be **transported from farm to hatchery in temperature controlled vehicles with air suspension.**

- The *most common risk is a sudden change in temperature and humidity at loading* which permits condensation.
- If road conditions are particularly bad, it is preferable to **pack eggs on fibre trays in boxes,** to reduce the risk of contact damage (hairline cracks or breakage).
- Vibration during transport can also cause the embryo to divide, showing up as an increase in duplication of feet, wings or head in the dead embryos or cull chicks.

REFERENCES

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Thank you!

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