

Factors affecting the quality of hatching eggs during production

Hatching egg quality is a crucial parameter for maximising the number of day-old chicks per hen and thus the profitability of the breeder flock. Good egg composition at the point of lay is necessary for optimising hatching egg quality. The internal egg composition and shell quality have an impact on the hatchability and quality of the day-old chicks.

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Multiple factors can affect hatching egg quality and optimal embryonic development:

Parent stock conditions:

- Health status.
- Age of the flock.
- Uniformity of the flock.

Environmental conditions:

- Feed and water quality.
- Housing design.
- Climate condition.
- Nest hygiene management.

Impact of the parent stock flock

1 Age of the parent stock flock

The age of the parent stock flock has a strong impact on the result of the hatchery.

For example, the percentage of second grade chicks is mainly correlated with the age of the donor flock.

Typically, a young flock less than 24 weeks gives lower results. Chick quality will normally improve with the age of the donor flock:

- Onset of lay (until around 30 weeks of age): The eggs are smaller with a lower yolk ratio and a thicker shell due to high calcium deposition.

This will lower the hatching results. Moreover, younger flocks transfer fewer maternal antibodies to the egg, resulting in a lower chick quality.

- Mid-production (30-50 weeks of age): This is an optimum period for hatching results and chick quality.
- End of production (beyond 50 weeks of



age): The shell quality is reducing and macronutrient absorption by the hen's decline. This will lead to lower hatching results and chick quality.

This underlines the importance of managing the age of sexual maturity. Sexual maturity and bodyweight at sexual maturity influence the production, egg size, and liveability, and thus the total number of hatching eggs per hen housed.

Too early a start of production often leads to insufficient egg size; a lower quantity of macronutrients is deposited in the egg and consequently chick quality is poorer.

2 Uniformity

Rearing is a key period for successful laying performances and achieving good flock uniformity.

During this period, it is necessary to reach the target bodyweight and flock uniformity to prepare the birds for the production period and obtain uniform eggs during the production period. The main objective is to reach the appropriate bodyweight and uniformity targets at different stages of the bird's development:

- At the early stage (0-7 weeks: period of frame development).
- At sexual maturity with an even growth curve (low bodyweight at sexual maturity could affect later performances).

- At the start of lay to the peak of production (a growth of at least 300g from 5% of lay until 30 weeks means that the bird's needs for egg production and growth are covered). Flocks with good uniformity will also produce eggs of good uniformity. This reduces the number of small eggs, the hatching window and will consequently lead to chicks of uniform size. Shell quality, egg weight and uniformity are important in determining the incubation parameters. The choice of incubation parameters, which corresponds to individual embryo development, is easier when the eggs are uniform.

3 Condition and health status

The sanitary quality of hatching eggs reflects the sanitary status of the flock. Thus, hatching eggs should be collected from healthy flocks who have had all the vaccinations recommended by local authorities administered. Some diseases can be vertically transmitted to the eggs, for example salmonella, mycoplasma, etc.

4 Production performances

Production level of and hatching results are often correlated. Avoid any factors that could affect the production, such as heat stress, management issue, diseases, etc.

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Impact of environmental conditions on egg quality

1 Feed

Whilst the composition of the macro-ingredients of the egg (water, proteins and amino acids, total fats and macro-minerals) is slightly dependent on feed ingestion, the trace elements, minerals and vitamins, and fatty acids from fats, vary according to the nature of the nutrients ingested.

Thus, unless a nutritional deficiency could lead to an impairment of the macro-nutrients placed in the egg, a feed too rich in protein or calcium, for example, does not enhance a better chick or shell quality. Ensure that nutritional requirements, especially the vitamins, are completely satisfied.

- **Vitamins A, D, E and some of the B group:** Egg content is directly linked to ingestion from alimentary tract.

- **Fatty acid:** Feed too rich in saturated fatty acids can lead to a reduced deposits of unsaturated fatty acids in the yolk and compromise a good start to embryonic development.

- **Calcium:** A good calcium diet improves eggshell quality. Shells that are too fine and/or cracked are more sensitive to pathogen contamination. It can also affect hatchability and chick quality.

2 Nest management

Managing nest is an important part to produce quality eggs. Dirty nests and floor eggs are often the main reasons for eggs exploding in setters or in hatchers and for chick contamination by pseudomonas and aspergillus or other contaminations.

- **The prevention of floor eggs:** Floor eggs are a multifactorial problem often related to management issue at the onset of lay or house and equipment design. The nest should be of sufficient numbers, with an easy access and with a uniform repartition within the house.

The entrance of the nest should be well lighted and the inside of the nest darker. It is possible to use a light nest to switch on one hour before the house light switch on. It

Liposoluble vitamins	
Vitamin D	Shortened beak
Vitamin E	Encephalomalacia, cornea oedema, immunity disorders
Vitamin K	Haemorrhages
Hydrosoluble vitamins (B group)	
Riboflavin (B2)	Stunting, oedema, clubbed down, curled toe, nerve degeneration
Pantothenic acid (B5)	Poor feathering, oedema, haemorrhages, fatty liver, twisted legs
Biotin (H)	Chondrodystrophy, parrot beak
Folic acid	Oedema, leg and beak abnormalities, early death after pipping
Cyanocobalamin (B12)	Haemorrhages, oedema, fatty liver, malposition, myotrophy
Minerals	
Calcium, Phosphorus, Sodium, Potassium, Magnesium	Decrease of eggshell quality
Manganese	Chondrodystrophy, parrot beak, globular head, oedema, retarded down feather, ataxia
Selenium, Zinc	Impairment of immune system development

Table 1. Vitamin or mineral deficiencies in breeders affecting egg quality.

enables the birds which are laying earlier to find the nest.

- **Nest management:** The nests must therefore be maintained clean at all times. They should also be equipped with a closing or ejection system to avoid nest occupation and staining at night.

Depending on ambient temperatures, the temperature in the nests may reach 30°C, as the hens produce heat and the litter acts as an insulating material. If eggs are left for too long in these conditions, the embryo starts to develop and becomes more sensitive to subsequent environmental change. This becomes more acute as the flock ages.

Egg should be cooled down uniformly and gradually to ensure embryo viability. The egg cooling rate depends on several factors, the most important being the frequency of egg

collection and the type of nest (manual or automatic). Depending on the nest equipment, the cooling rate will be different; consider collecting at least four times per day for manual nests and three times per day for automatic nests.

Conclusion

Producing good quality eggs requires correct management from the rearing period during flock growth to the start of production, with nest management, feed management, etc. Preserving the viability of the embryo is the responsibility of the farm and the hatchery. Good knowledge at all levels is essential to ensure flock performance and therefore hatchery performance. ■



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