

Factors Affecting Shell Quality

Shell quality is one of the most important factors that influence hatchability. The shell thickness and porosity help to regulate the exchange of carbon dioxide and oxygen between the developing embryo and the air during incubation (3). Shell thickness also has a very significant effect on moisture loss during incubation. Thin-shelled eggs lose more moisture than do thick-shelled eggs, causing the chick to have difficulty hatching (3). Thin-shelled eggs also have a much greater chance of being cracked during handling. Although shell quality can generally be manipulated through nutrition, there are several other factors that can have an effect, such as disease and management.

The easiest measure of shell quality is specific gravity. Salt solutions are prepared in garbage cans, using a hydrometer to set the specific gravity of each solution. The eggs are then placed in each solution, from the lowest specific gravity to the highest. The more eggs sink, the thicker the shells. This test can be performed easily on the farm or in the hatchery. Below is an example of typical results:

Specific Gravity	% Floaters
1.065	10
1.070	30
1.075	60
1.080	85

The results shown here are average, but could be improved by considering some of the factors that affect shell quality.

Management

Temperature of the barn has a very significant effect on shell quality. Along with calcium, the shell is made up of carbonate. Carbon dioxide from the blood is used in shell formation. It has been shown that the increased respiration of the birds during unusually hot conditions results in depletion of carbon dioxide in the blood and reduced availability of calcium carbonate for shell formation (4).

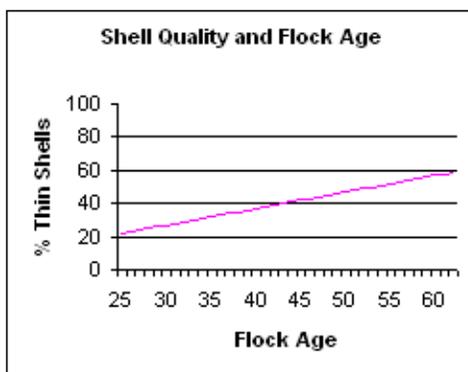
Handling can also affect shell quality after lay. Rough handling can cause small, almost invisible cracks in the shell that make the egg more prone to bacterial infection (1). Washing the egg with some disinfectants will also cause problems. Some products will clog the pores in the shell, reducing gas exchange and causing poor hatchability. In addition, some disinfectants can remove the cuticle from the eggs surface, leaving it feeling chalky. The cuticle serves as a barrier to microbes, removal can increase the number of rotten and contaminated eggs (2). Most hatcheries prefer that eggs not be washed, just wiped clean.

Disease

Disease in general has a negative impact on shell quality, among other production traits. The stress caused by a disease challenge can reduce water and feed intake of the affected birds. Reduced feed intake will cause a calcium deficiency, which will cause shell problems (4). There are also several diseases that can directly affect shell quality. For example, the infectious bronchitis virus can cause soft or rough shells, discoloration, and/or wrinkling of the shell (4). If disease is suspected to be a factor, consult your veterinarian for advice.

Flock Age

Shell Quality has been shown to decrease with age of the flock. There are two main reasons for this. First, older flocks lay larger eggs. These larger eggs require more shell, but the hen is unable to increase the amount of shell that is produced, resulting in thinner shells. Second, the hen loses some of her ability to mobilize calcium from the bone, and is less able to produce the needed calcium carbonate (3). For these reasons the expected specific gravity declines with age. The chart below shows the expected percentage of eggs with thin shells (<1.080) as the flock ages (5). Studies have shown that eggs from older flocks with high specific gravity hatch as well as those from young flocks (3).



Nutrition

One major dietary component affecting eggshell quality is calcium. Each egg contains up to 2.5g of the calcium. Both excess and deficiency of calcium will negatively affect shell quality. Excess calcium will cause reduced feed intake, which will affect shell quality, as well as production (2). There are other nutrients, such as vitamin D, phosphorus, and manganese, which will also cause poor shell quality if they are improperly balanced. Vitamin D is vital in the absorption and mobilization of calcium during shell synthesis (2). Phosphorus is a key component of bone, along with calcium. High levels of phosphorus in the blood will inhibit the mobilization of calcium from the bone. Manganese interferes with the metabolism of calcium, and can cause poor shell quality if it is in excess in the diet (2).

Although the diet may have sufficient calcium, shell quality may still suffer. The requirement for calcium is highest when the shell is being deposited on the egg. This occurs during the hours just prior to lay, which is usually at night when it is dark and feed is not available (1). Supplying large particle calcium, such as oyster shell or large particle limestone, in the feed or spread on the litter, can be effective in allowing calcium to be available during shell synthesis. The use of drinking water supplements, such as vitamin D3, calcium, and phosphorus will help the birds absorb calcium and make it more easily available in the short term. If nutritional problems are thought to be the cause of poor shell quality, consult your poultry veterinarian or feed representative for advice.

Summary

Shell quality problems are usually easily resolved, but can be costly if they are not dealt with quickly.

Acknowledgements

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References

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