Crack detection for egg shell stability

Eggs with damaged shells will not be purchased by consumers and this can lead to extensive economic losses.

The contents of these cracked or broken eggs are not sufficiently protected from external effects and the tiniest hairline crack in the egg shell is enough for microbial pathogens to contaminate the interior of the egg. In such cases, the quality of hatching eggs as well as eggs for consumption is downgraded.

Should unidentified contaminated eggs find their way into the market place, this could become a huge health hazard for consumers. The image of the egg sector strongly suffers from incidences of this kind and this is why it is so important to effectively improve egg stability.

Several different factors influence the quality of the egg shell and with that, the breaking strength of the egg directly.

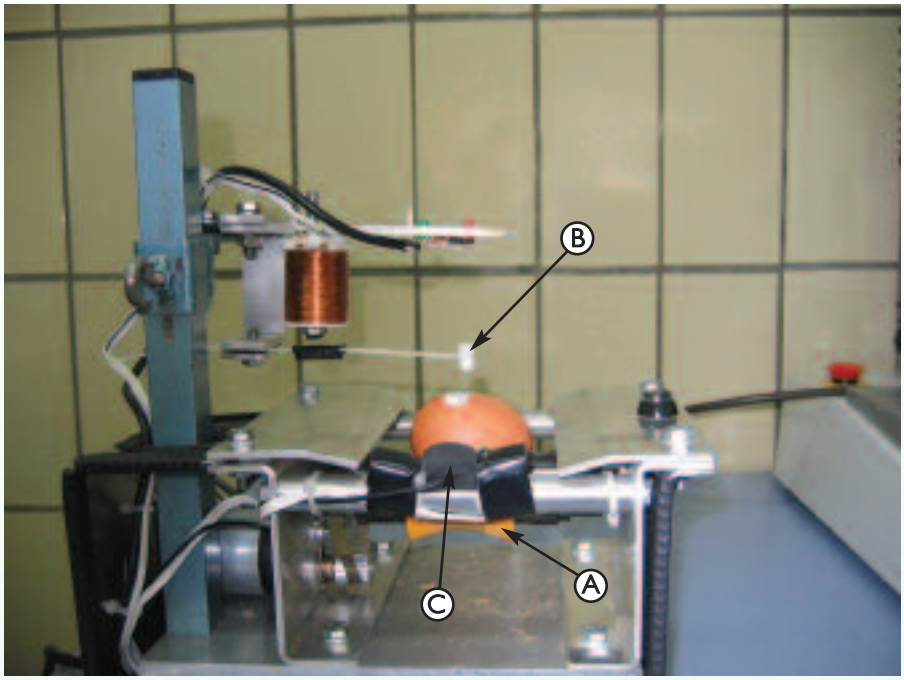
These include genetic assessment, age, feed, diseases, management, water quality and other environmental influences such as temperature and stress. In both routine quality controls as well as in performance tests carried out on breeding farms, the breaking strength is measured with the help of equipment which clamps the egg between two pressure plates.

The static pressure on the egg is increased as long as is needed until the egg breaks between the two pressure plates. The reacting pressure capacity at this point of time between the egg poles is the measured breaking strength value in Newtons.

This breaking strength measurement is carried out annually at the performance test institutions. However, it has the disadvantage that the egg breaks during the first measurement and is, therefore, not available for further testing.

This problem is solved with Lohmann Tierzucht's newly developed measuring system – the Crack Detector. This device operates under the same physical principle as the great commercial egg graders which sort out eggs with hairline cracks and other shell damage.

Measuring the breaking strength.



Crack detector for single egg evaluation. A: roller device, B: hammer at magnetic coil, C: microphone for oscillation measurement.

The surface of the egg is cautiously knocked on four times with a little hammer at different areas as the egg is being turned around on its equatorial axis so that the egg does not get damaged. Each and every strike leads to minimal oscillation of the egg shell which is recorded by a microphone situated nearby.

These so called oscillation frequencies are similar with eggs which are intact, whereas the frequencies in defected eggs show a large part of total variance. Four knocks, respectively the frequency of each egg, suffices to calculate the new parameter 'Kdyn: dynamic stiffness' which determines the shell stability.

Another advantage of the Kdyn indicator is that compared to a conventional breaking strength measurement, which often leads to damage in egg shells in practice, a light hammering of the Crack Detector simulates an ideal dynamic pressure. The resilience of each egg against outer influences can be reliably tested in this manner and, in addition, there is a possibility for a precise evaluation on whether an egg is 'damaged' or 'not damaged' in terms of the egg shell stability.

Above all, it is the promising, genetic related characteristic which is interesting for the poultry breeder. Research on various lines of Lohmann Tierzucht have shown that the value of Kdyn up to 40% is genetically determined and that the correlation to breaking strength value is close.

This means that the conclusion of the two egg stability characteristic traits Kdyn and breaking strength incline in the same direction but they are not identical.

Thus, further conclusions of egg stability are made possible with the assistance of the feature 'dynamic stiffness' which could not be done before on the basis of the breaking strength.

Combined with relatively high heritability for the shell properties, the selection of hens according to the attributes of Kdyn promise improved egg shell stability and, with that, less eggs with shell damage. ■