Infectious bronchitis and eggshell quality

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A lot of factors affect hatchability and, amongst them, eggshell quality plays a very important role. In addition, many factors affect eggshell quality and infectious bronchitis is one of them. A significant drop in egg production is a typical symptom of infectious bronchitis.

Although flocks are generally vaccinated against infectious bronchitis in the rearing period, some flocks can be pressurised by this virus without showing typical symptoms.

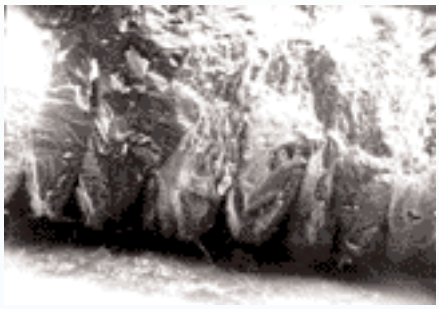
It can, therefore, be difficult to determine the real reason for reduced eggshell quality and hatchability.

Materials and methods

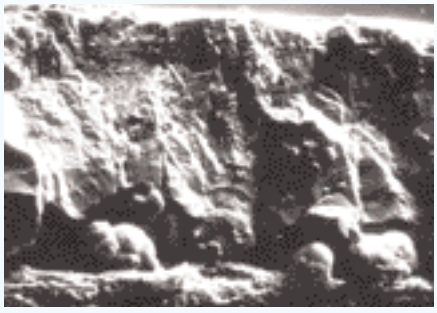
Unusual low hatchability was observed in parent stock of ISA Brown at 34 weeks of age. Therefore, 4,800 freshly laid eggs were incubated and an analysis of embryonic mortality was carried out.

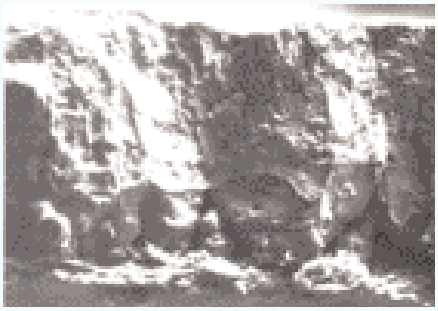
Eggs were incubated in a commercial hatchery under standard conditions.

At 13 days of incubation, all eggs were candled and those which did not appear to have a live embryo were removed and broken in order to determine if the egg possessed an early dead embryo, or was infertile.



Above left, an eggshell with a high microstructure quality. Above right and below, eggshells showing a lot of structural defects.





After 21 days of incubation, all unhatched eggs were broken open to determine the stage of embryonic death.

For eggshell quality (strength, thickness and eggshell weight ratio) an extra 50 eggs were analysed. Relative eggshell conductance was measured according to Peebles and McDaniel.

The flock was vaccinated against infectious bronchitis during the rearing period.

Parent stock	Fertility	Hatchability of all eggs set	Incubation period when embryonic mortality occurred (%)					
			1-7 days	8-14 days	15-20 days	External pipping	Microbial contamination	Dehydrated
ISA Brown 34	95.8	77.1	9.3	3.1	4.7	0.6	0.4	0.7
Bovans Goldline 38	98.3	84.7	5.6	0.6	6.5	0.9	0.04	0.0

Table 1. Fertility, hatchability and embryonic mortality (%).

The blood samples of ISA Brown were analysed by ELISA for antibodies against infectious bronchitis at the end of the production period. The following year the flocks were revaccinated, also during the production period.

The data of IB were compared with parent stock of Bovans Goldline at 38 weeks of age (9,600 eggs).

Results and discussion

Although the flock of ISA Brown was vaccinated during the rearing period, on the basis of serological investigation the flock was under pressure from infectious bronchitis. But, a typical decrease of egg production in ISA Brown was not observed.

The laying intensities in the flocks was 88.5% in ISA Brown and 90.8% in Bovans Goldline. Broadfoot and Smith (1954) and Bisgaard (1976) reported 60-85% and 20-90% (respectively) decreases in egg production in infected flocks.

The fertility, hatchability and embryonic mortality are shown in Table 1. The fertility and hatchability of all eggs was significantly higher (P<0.01) in revaccinated flocks of Bovans Goldline. Broadfoot and Smith, noted the decrease of hatchability due to infectious bronchitis in the range from 3-8%, the difference between ISA Brown and Bovans Goldline was 7.6%.

The highest embryonic mortality was found in the first and in the last third of incubation. But, unusually high embryonic mortality was found in the second third of incubation in ISA Brown.

In Bovans Goldline the mortality was significantly (P<0.01) lower in this period. Fasenko et al. found mortality to be 0.7% or lower in the period from 8-14 days of incubation.

Also, higher incidence of microbial contaminated eggs and dehydrated eggs was found in ISA Brown (P<0.01). Significantly lower eggshell strength (P<0.01), eggshell weight (P<0.05) and eggshell thickness (P<0.01) were found in ISA Brown (Table 2). Roque and Soares, found an increased hatchability in thick shelled eggs in comparison with thin shelled eggs.

McDaniel et al. reported lower hatchability and higher early and late embryonic mortality in eggs with lower specific gravity (P<0.01).

They also indicated that fertility and shell quality (specific gravidity) are associated (P<0.01). Peebles and Brake noted that conductance appears to be a useful indicator of hatchability but insignificant difference was observed between the ISA Brown and Bovans Goldline.

Photographs of eggshells with the highest conductance were made under electronic microscope. The first photograph (top left) shows an eggshell with high microstructure quality. In the other photographs a lot of defects in eggshell microstructure are shown.

The 'windows' are probably filled by water, which should explain the high mortality from 8-14 days.

From day nine the embryo increases the oxygen demand and the defects in the microstructure of eggshell affect the pore structure and, consequently, gas exchange and the allantois blood circulation did not work properly.

However, conductance as a function of water evaporation was not affected. ■

References are available on request from the author

Table 2. The quality of eggshells.

Characteristics	Bovans Goldline 38	ISA Brown 34	p-values
Egg weight (g)	62.3	61.0	NS
Eggshell strength (N)	45.1	39.6	<0.01
Eggshell weight (g)	6.58	6.37	<0.05
Eggshell weight ratio (%)	10.6	10.7	NS
Eggshell thickness (mm)	0.447	0.428	<0.01
Relative eggshell conductance (mgH_2O/day/Torr/100g)	12.1	12.8	NS