ENG

Technical Tip

INTERNATIONAL

The key to your profit

Chick quality

It is told that first impression is critical, and in our industry this is related with chick quality at arrival. Having this in mind, it is very important to have the procedures and tools to help us evaluate chick quality at hatchery and at arrival on the farm and with that information we can make the corrections to improve it.

At the hatchery is critical to understand if the incubation conditions were optimal and when necessary, make corrections and assure the best quality is sent to our customers. On the other hand, during placement is important to not only assets the incubation conditions but also to check if both holding and transport conditions were optimal, and furthermore to be sure we are receiving the best quality.

The purpose of this technical document is to provide guidance to hatchery and farm managers to evaluate chick quality. This document is arranging the factors in three categories: preincubation, incubation and post incubation.

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Pre-incubation factors impacting on chick quality:

1

Nutrition of parent stock.

Health status of parent stock.

Quality of hatching eggs.

Egg storage and transport to the hatchery.

Incubation factors impacting chick quality:

2

Incubation environment (temperature, oxygen, CO2, ventilation, and turning)

Eggshell temperature.

Transfer.

Hatching window.

Pull out time.

Post-incubation factors impacting on chick quality:

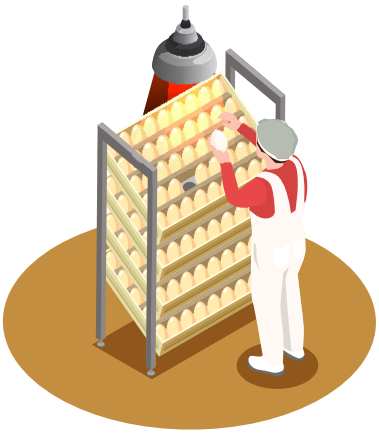
3

Chick holding conditions (temperature, humidity, ventilation, and light).

Transport conditions (temperature, ventilation, and humidity).

Brooding conditions during first four days after placement.

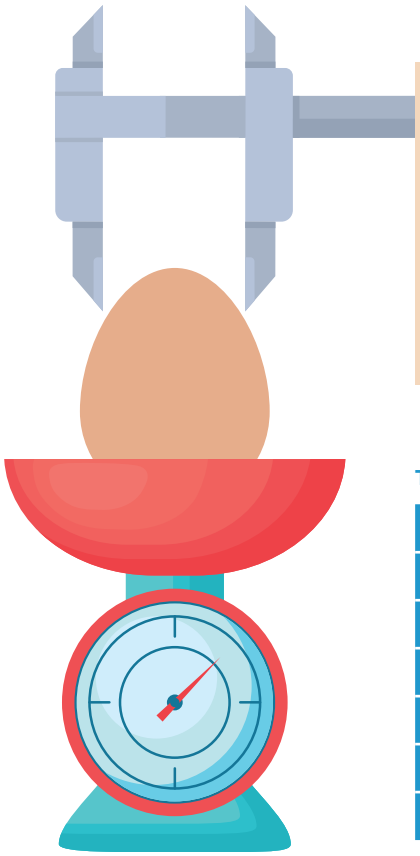
As you can imagine, chick quality starts at the breeder farm. In this technical document we will review the most important factors impacting the quality and how the hatchery managers at hatch and farmers at placement can evaluate it.



Pre-incubation factors impacting on chick quality.

Quality of PS flock determines the HE quality.

1. **Management on the farm**: for example, poor feeding management affecting performance and eggshell quality.
2. **Age of the PS:** as the flock ages the eggshell quality decreases. While hens younger than 30 weeks of age could produce more immature chicks which require the best brooding conditions (thermoregulatory system development) hens older than 67 weeks produce poorer egg quality (eggshell and internal quality).
3. **Health status of the PS**: any disease impacting on eggshell quality and/or internal quality (infectious bronchitis), and chick quality and livability (salmonella, Escherichia coli, mycoplasma, chicken anemia virus, avian encephalomyelitis etc.). Therefore, it is important to have a monitoring plan and evaluate the status of these diseases.
4. **Feed quality**: is critical to follow the recommended levels of vitamins and minerals from the management guide. Not following them could decrease chick quality, fertility and/or hatchability. Always check the label of the vitamins/minerals premix and confirm that the levels are within the optimal range. This is even more critical in hot weather conditions and/or in situations of drop in feed intake. Optimal premix storage is critical to prevent a decline in vitamin levels.
5. **Water quality**: suboptimal water could carry diseases, toxins, or high levels of minerals. A constant water disinfection is critical to prevent bacteria or viruses. It extremely important to check periodically the microbiological and mineral quality of the water.
6. **Characteristics and quality of hatching eggs**



Egg weight: Incubate eggs of at least 50 g and from flocks of at least 22 weeks of age. Ideally incubate batch of eggs averaging 58 to 61 g (between 50g and 70 g) with good uniformity (>90%). This contributes to have good hatchability, hatch window and chick quality.

Egg shape: depending on the abnormality is the degree of impact on hatchability (see table 1). Only incubate normal shape eggs.

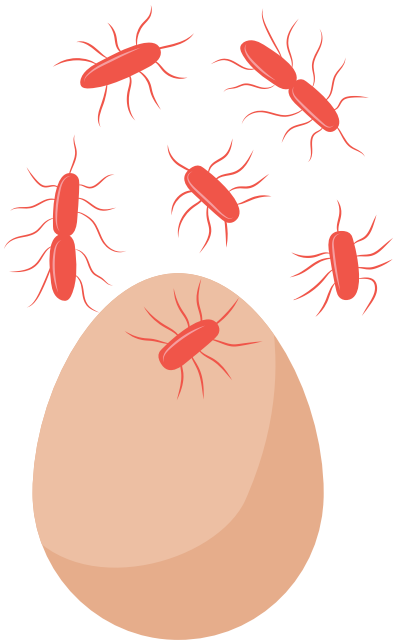
Table 1. Egg characteristics and the impact on hatchability

Abnormality	Hatchability %
Normal	74
Ridged	65
Round	63
Small	62
Pimpled	19
Wrinkled	13

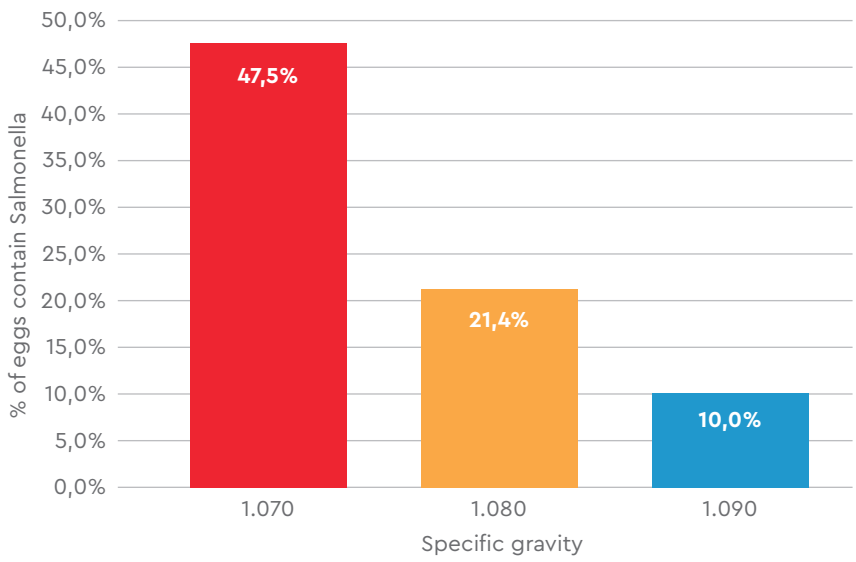
Adapted from Banday and Bakat, 2014

Egg shell quality: good eggshell provides protection and optimal Ca source and homeostasis for a good embryo development. Flock age, nutrition, season, and management impact on eggshell quality.

Eggs with poorer eggshell quality are more susceptible of bacterial contamination affecting chick quality (see graph 1).



Graph 1. Percentage of eggs of different shell specific gravity containing viable Salmonella 24 hours after challenge by species of Salmonella. The higher the specific quality the less eggs positive to Salmonella.

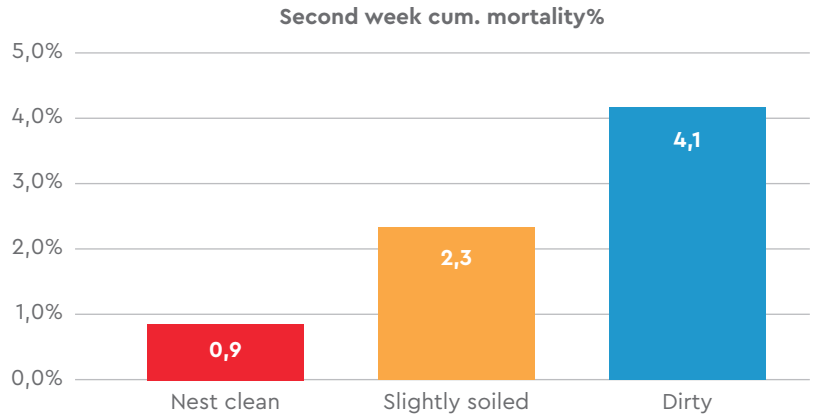


Adapted from Sauter and Petersen, 1974

Clean eggs: Only use clean eggs. Never use floor eggs. To prevent floor eggs and improve the nest utilization, it is critical to achieve a good training in rearing. Disease, nutrition, water quality, management, cleanliness of the nest (and egg belts) and characteristics of the equipment play and important role in having clean eggs.

When incubating dirty egg there is always risk of hatching chicks that may have high morality due to bacterial diseases (see graph 2 and table 2).

Graph 2. Impact of nest clean condition in cumulative mortality at second week.



Adapted from Mauldin, 2008 (engormix.com).

Table 2. Effect of nest clean status in bacteria count and cumulative mortality at second week.

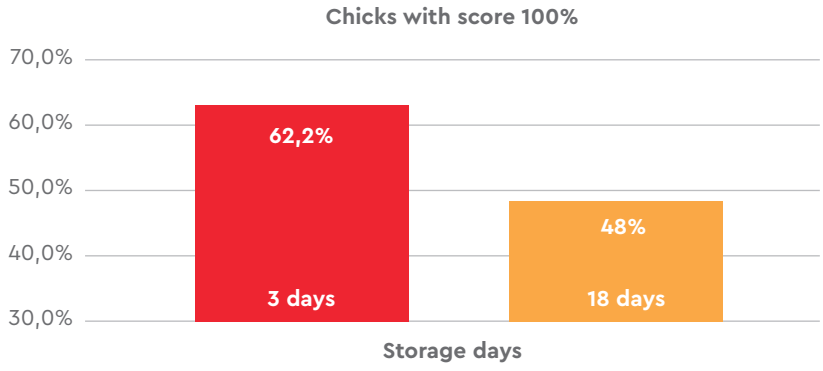
Egg source	Total bacteria	Coliform	2 week mortality %
Nest clean	600	123	0,9
Slightly soiled	20.000	94	2,3
Dirty	80.000	1307	4,1

Adapted from Mauldin, 2008 (engormix.com).

Egg storage: the longer the storage the poorer the chick quality. Research done by Tona (2003) showed the longer the storage time of hatching eggs the poorer the chick quality (see graph 3). In addition, the body weight gain at z7 days after placement is lower in chick hatched from eggs stored for a long period (> 14 days). Short Period of Incubation During Egg Storage (SPIDES) can be used to mitigate the impact of long storage.

Graph 3. Effect of storage days on chick quality.

Score 100%: best chick quality. Therefore, poorer quality means lower %.



Adapted from Tona et al., 2003.

7 **Transportation of Hatching eggs:** Transport the hatching in clean and disinfected truck. Designated only for hatching eggs transport. The temperature should be within the range of 18 to 22°C and relative humidity between 40 to 60%. Condensation on the eggshell must be avoided at all costs because moisture on the eggshell impairs the natural mechanism of defense of the egg against microorganism and provide optimal conditions for microorganism multiplication. The table below can be used to predict if condensation will occur when no additional measures are taken.

Table 3. Prediction whether sweating will occur if no additional measures are taken.

Temperature of storage room and eggshell	Temperature outside the storage room			
	15°C	18°C	21°C	24°C
21°C	-	-	-	>85% RH
18°C	-	-	>83% RH	>71% RH
16°C	-	>89% RH	>74% RH	>60% RH
12°C	>74% RH	>64% RH	>53% RH	>44% RH

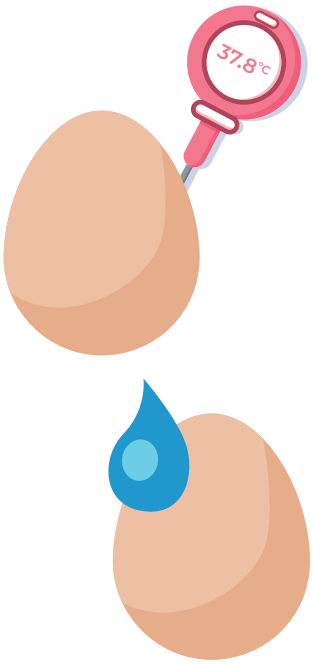
Adapted from Gerd de Lange, 2011 (poultrysite.com). For a wider range of temperatures and humidities use a psychometric graph.

Incubation factors impacting on chick quality.

Temperature: eggshell temperature should be between 100–101°F (37.8–38.3°C) until hatch. Higher or lower than optimal EST will impact on hatchability, incubation time and chick quality (see graph 4). This is the most important incubation factor.

The EST must be frequently evaluated, and a written procedure should be followed. Optimal body temperature must be followed post transfer to prevent overheating (dehydration) or chilling chicks in hatchers which will impact on chick livability.

When comparing with multistage setter (MS), single stage can produce better chick quality by maintaining the optimal EST during the incubation period. However, MS can still develop good quality chick when the machine is adequality managed.



Humidity: setter humidity must be set to achieve an egg weight loss (EWL) between 11,5–13,5% at transfer (18,5 days of incubation). Suboptimal EWL impact on hatchability (increase of late dead), chick quality and 7-day livability. Low EWL could produce chicks with a large yolk sac which affect hatchability and increases the risk of bacterial contamination.

It is critical to have a standard procedure to check EWL on a regular basis.

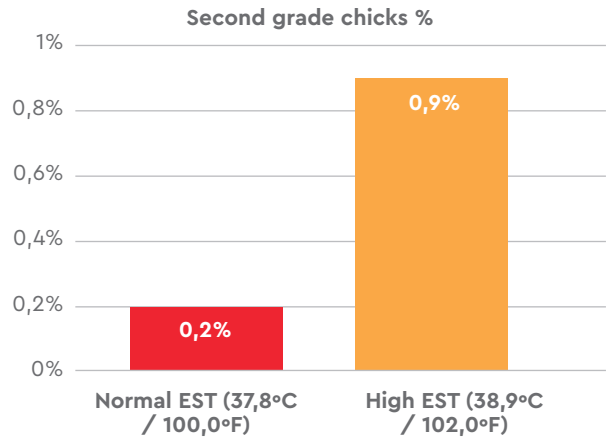
Turning: angle and frequency. Turning failure, suboptimal frequency (more than 60 minutes per turning) or angle (< 38 degrees) have a big impact on hatchability (see graph 5) and chick quality due to a poor development of chorion allantoid membrane, yolk utilization and eggshell temperature uniformity. It is important to regularly check the turning frequency (every day) and turning angle (at least evert 6 months.)

Transfer: Transferring hatching eggs from setter to hatcher must be done at the right day (best is 18–19 days of incubation) to maximize hatchability and chick quality. Handling of the eggs is critical to prevent eggshell cracks and must be done fast to prevent the eggs staying for too long at room temperature.

Hatching window. The hatching window is a result from preincubation and incubation factors. The optimal range is between 20 to 28 hours in multistage and less than 18 hours in single stage machines. A long window means that incubation conditions were not uniform (low EST or not uniform ESTs), egg storage was long, egg sizes were not uniform, different parent flock ages, among other factors. This impact on chick quality, chicks become dehydrated, and body weight uniformity. Everything must be done to achieve optimal hatching window.

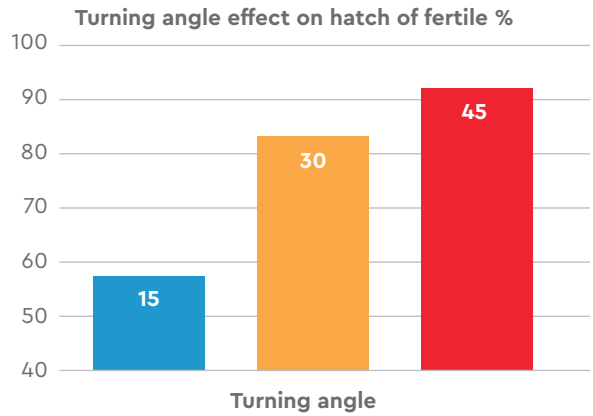
Pull-out time. Chicks must be pulled out from the hatcher on the right time to prevent dehydration or too green chicks. Both conditions impact on chick livability.

Graph 4. Impact of high EST on % of second grade chicks (first grade = best quality; second grade = poorer quality)



Adapted from Molenaar et al, 2011.

Graph 5. Effect of turning angle on hatch of fertile %

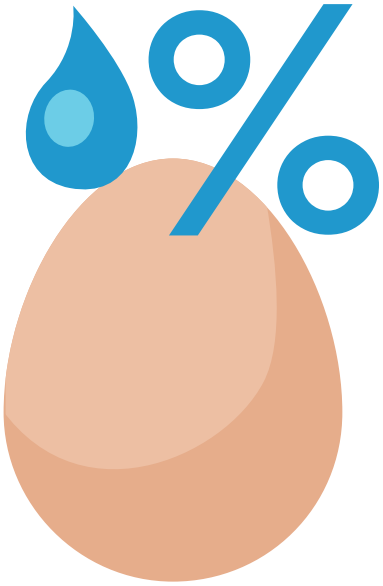


Adapted from Wineland, 2009.

Table 4. Effect of relative humidity (RH) on incubation parameters and body weight at hatch (RH of 53% was optimal in this trial).

Variable	Relative Humidity		
	43	53	63
Infertile (%)	7,4	8,3	7,3
Early dead (%)	8,2	7,1	8,5
Late dead (%)	3,0b	2,3b	4,5a
Pipped (%)	0,9	0,5	0,8
Fertile hatchability (%)	86,6b	89,1a	86,3b
BW at hatch (%)	39,4c	40,2b	41,2a

Adapted from Bruzual, 2000



Post-incubation factors impacting on chick quality.

1. **During chicks processing.** Evaluate the different areas during processing that can impact on chick quality. For example, chick counter, beak treatment, vaccine injection, sexing, among others.

2. **Holding room and transportation** of day-old chicks

   - Optimal temperature is 20 to 25°C with a relative humidity between 50 to 60%. Constant monitoring of these two parameters is essential and a data logger is the best option for an optimal evaluation.
   - Optimal ventilation allowing uniform temperature distribution, preventing chilling and overheating.
   - Always check vent temperature and behavior. The vent temperature should be 104–106°F (40–41°C). Monitor this temperature in each step of processing (pull out, sexing, vaccination, beak treatment, inside chick boxes, etc).
   - Transportation must be smooth and shortest as possible. Long transport impact on chick quality and livability (dehydration).
   - Clean and disinfected designated trucks (only for day old chicks transport) to prevent infectious diseases.

3. **Brooding conditions:** temperature, feed, water, and ventilation are critical to achieve good 7-day livability. Incorrect temperature, wrong feed presentation or quality and lack of access to water will impact on chick quality and livability.

Chick quality

How should be a good batch of chicks?

- Good livability
- Good body weight (68% of fresh egg weight)
- Good uniformity (>90%)
- Disease free.
- Good level of maternal antibodies
- Alert and active
- Physically perfect
- No signs of dehydration.

Evaluation of chick quality

Areas to assess general chick quality and behavior.

Prior or during pull out.

On processing belt

After sexing

After vaccination and beak treatment

In chick boxes prior to delivery

Chicks behavior

At hatchery:

- Do not lay down

- Must be very active

- Chicks should not be noisy. If they are making too much sounds means that they are under some stress (for example, low or high temperature)

At farm:

- Chicks at placement must be very active

- They must start eating and drinking almost immediately.

There are qualitative, quantitative, semiquantitative and microbiology methods to precisely evaluate chick quality. Regardless of the method to is important to have a good representative sample and must be done after processing and selection.

Qualitative methods

Behavior (not moving? Laying down, etc)

Navel quality (black button, string, etc)

Beak quality (beak treatment, red dot on beak, etc)

Hocks and leg quality (red lesions, dehydration lesions, etc)

Abdomen characteristics (is it too big?)

Quantitative methods

Body weight and uniformity

Yolk free body mass (YFBM) and Residual yolk (RS)

Chick yield

Chick length

Semiquantitative methods

Scoring system: Tona, Pasgar or Cervantes

Body weight and uniformity

100 chicks per flock (individual weight) after processing and selection.

Important are the uniformity (> 90%) and CV (<8)

Influenced by residual yolk weight, flock age, hatching window and pull-out time.

The bigger the yolk the heavier the chicks. This is not always good because a good yolk utilization translates into better immunity, gut health, embryo and chick development.

Yolk free body mass (YFBM) and Residual yolk (RS)

Weight each individual chick and the residual yolk.

YFBM = BW (body weight) – RS

Optimal YFBM > 90% and goal is to achieve less than 10% residual yolk sac from BW at hatch.

Higher the EST, lower the YFBM and quality.

Good predictor but time consuming and destructive method

Chick yield

BW of chicks at hatch as a % of egg weight prior to setting (less than 7 days of storage).

3 setter trays per flock per machine.

It is not necessary to weight individual chicks but all chicks that hatched from those 3 trays.

Optimal result is between 67 to 68%

< 67% dehydrated (too much time in hatchers? high 7d mortality? High EWL?) and > 68% too "green" (lethargic, low EWL? prone to bacterial infection).

This method helps to evaluate chick quality, and at the same time setter and hatcher conditions.

Tona, Pasgar and Cervantes Scores

Semiquantitative methods.

Results could vary among evaluators.

Based on morphological characteristics

Cervantes metho includes bacterial contamination.

All three evaluate: activity, posture, belly, navel, legs, beak, and eyes.

Pasgar score is more simple and more practical to use.

Other evaluation methods

Hatch analysis and residual breakout. The % of chicks dead on hatcher tray must be 0%.

Cull rate %: less than 0,5%

Dead on arrival: less than 0.2%

It is important to measure chick's vent temperature in different areas of the hatchery: pull out, processing room and holding room. A sample of 15 birds is a good number to do the evaluation. The goal is a temperature of 104–106°F. If temperature us lower or higher than the optimal, corrective measures need to be taken.

7-day mortality: less than 1%

Crop fill score: evaluate 100 chicks at 12 hours upon arrival. The goal is to have >95% of chicks with feed in the crop.

Chick Length

Good relationship with yolk utilization and less time consuming and destructive method than YFBM method.

Low sample number (25 should be enough)

Variability between people.

Good method.

It requires to develop your own standard. The optimal length depends on flock age.

It is influenced by incubation conditions and flock age. Weight each individual chick and the residual yolk.

YFBM = BW (body weight) – RS

Optimal YFBM > 90% and goal is to achieve less than 10% residual yolk sac from BW at hatch.

Higher the EST, lower the YFBM and quality.

Good predictor but time consuming and destructive method

Chick check (ask technical team for detailed information)

It is a microbiology method to evaluate chick quality.

Sampling 10 healthy chicks per flock (right after pulling out)

Yolk swabs for bacterial cultures

Assess bacteria growth on:

Blood agar

McConkey agar: for gram negative

PEA agar: for gram positive.

Lung tissues for mold (Aspergillus spp) on SabDex agar.

Pool of viscera and intestines for Salmonella culture

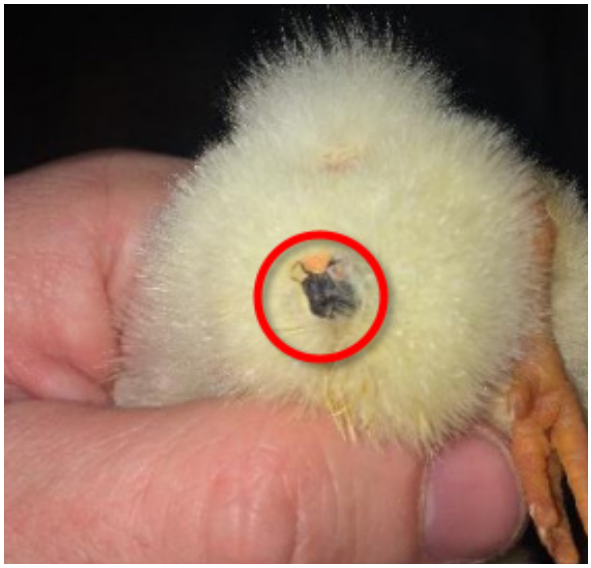
Always evaluate leg, navel, and yolk quality. Presence of gizzard erosions

This method helps to evaluate farm and hatchery sanitary conditions.

A good option is to leave chicks for 48 hours under optimal conditions at the hatchery and after that period take the samples.

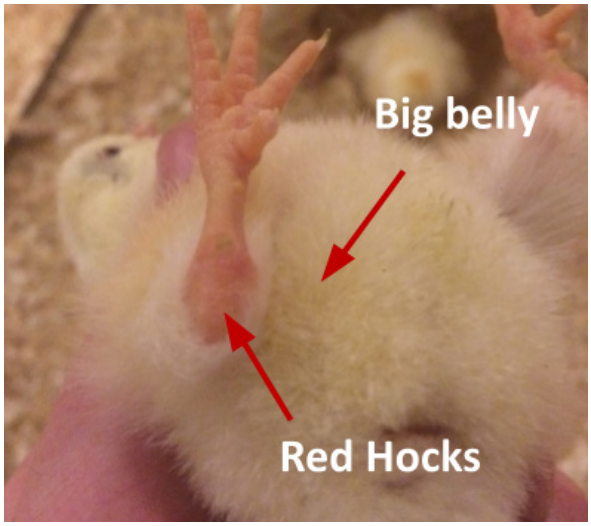
Navel quality

Nave quality is affected mostly by egg storage, breeder age and incubation conditions.



Red Hocks

Red hocks are in general associated with high temperature and/or high humidity during incubation



Big belly is associated with suboptimal incubation temperature and high humidity during incubation. It appears often associated with red hocks.

When too much meconium It is found on eggshells and hatcher trays means that chicks stayed for too long inside the hatchers. Corrective measures must be taken: adjust incubation hours, pull out earlier, evaluate egg shell temperature (maybe is too high) and check incubation humidity (maybe too low).

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