Egg breakout as a hatchery management tool

The most important tool to have in a hatchery is one that will diagnose hatch problems. To be effective in pinpointing hatch problems, conducting an egg breakout is a necessity. Hatcheries set goals for themselves, and an egg breakout helps us understand where we are in relation to those goals.

The first thing to know is the fertility of the flock. Once fertility has been established, then the potential can be realized by calculating Hatch of Fertile.

Example: (86.4% Hatch ÷ 96.0% Fertility) x 100 = 90.0% Hatch of Fertile

If you have the type of incubator that can be candled easily, the first step is to candle the eggs at 10 to 12 days of incubation. Select at least 4 trays from different locations within the incubator, top, middle and bottom. Mark the trays candled to indicate that these trays need to be saved for a 21-day residue breakout. Remove and breakout the clear eggs to determine whether the egg was infertile or an early dead.

INFERTILE
- No development

DAY 1
- Appearance of tissue development

A candle breakout is a good tool to provide accurate fertility data. If you have an incubator that does not lend itself to conducting a candle breakout, then a residue breakout can still be performed by examining the unhatched eggs left in the hatching tray. An embryo diagnosis worksheet should be used when conducting a breakout. This tool enables personnel to gather accurate, reliable data and present it a usable form. Every egg broken out should fit into one of the following categories:

EARLY DEAD, which is between 1 and 7 days of incubation;

MIDDLE DEAD, 8 to 14 days;

or LATE DEAD, which is 15 to 21 days.

A reference chart is beneficial to assist in accurately identifying the day the embryonic death occurred.

The information recorded during the breakout should be used to create both flock and machine histories. By maintaining complete and accurate data, it will be possible to establish trends and predict hatchability. One of the most important keys to diagnosing problems is looking for patterns and not getting confused by isolated incidents. We need to be sure we have conducted a thorough diagnosis before forming conclusions. Once accurate trends have been identified, an action plan for hatch improvement can be implemented and the results monitored. If the results in any one category fall below standard, check the flock and the machine again. Re-check the same flock in a different machine to identify the actual problem. Never make a decision based on one breakout.

A properly performed breakout can be the best tool in a hatchery. The breakouts are best performed by using only one or two well-trained persons in each location in order to have consistent observations. Hatchery and breeder managers should have the results as soon as possible. They can then monitor the results, feel confident in the accuracy, and take the proper steps to improve hatchability.

The importance of hatchery sanitation (part 1)

The mission of a commercial hatchery is to produce large numbers of quality broiler chicks. Factors influencing this goal include contamination, extended hatch windows, diseases, infertility, etc. Most of these challenges cannot be influenced easily, with the exception of one - contamination. Contamination is most often caused by a lack of sanitary conditions at the hatchery.

Sanitation Programs

Sanitation programs must have the employee's safety in mind at all times. Employees must be trained properly and documentation of the products used should be made available. Obtain product data sheets from the chemical manufacturers and follow their guidelines carefully. A Material Safety Data Sheet (MSDS) catalogue must be kept, training on use of the products carried out frequently, and personnel cross-trained on the use of the multiple products that are utilized in every hatchery.

Selecting the proper sanitation program should be designed around the specific needs of each hatchery.

The hatchery is trying to eliminate or reduce the bacteria and mold produced by the incoming eggs, the roof top equipment, transportation vehicles, automation equipment, personnel traffic and from the entire hatchery flow itself.

Nothing is more effective than a correct cleaning program. All organic matter must be removed before any disinfectant will work. Products will not be effective on dirty surfaces.

There are several areas that need constant attention:

It is important to clean all **egg flats** before returning them to the farm. Any equipment in the hatchery that the eggs come in contact with should remain clean and disinfected.

Tray washer maintenance to keep the water clean with the proper detergent and disinfection system, particularly on the final rinse, while maintaining the correct water temperature are all critical factors. Most dirty trays are due to clogged nozzles, the boiler or circulating pumps not working, or air is in the lines which needs to be purged.

The **heating coils** also need to be treated to keep the scale from building up and becoming inefficient. Sometimes the chain speed is too fast and the trays don't have enough chamber time to be sanitized.

A good hatchery sanitation program is often the difference between broiler chicks of poor quality and good quality. A detailed sanitation Standard Operating Procedure which is well thought out, monitored closely, and adjustments made quickly, is a must for giving the chicks a start that will allow them to perform to their maximum genetic potential when placed on the growout farm.

Importance of daily routine in hatchery sanitation (part 2)

The goal of a commercial hatchery is to produce large numbers of quality broiler chicks. Designing and implementing the correct sanitation program for each hatchery is vital, so too are routine daily tasks.

All rooms should be cleaned and disinfected daily. Box pads, chick boxes or any unused equipment stored in the wrong place will interfere with the effective cleaning and disinfection of an area.

When renovating or building new hatcheries, we should always keep the egg-to-chick flow in mind for biosecurity. This also applies to personnel flow. Foot baths placed throughout the hatcher make an excellent biosecurity barrier between a clean and dirty area. Traffic should be kept to a minimum.

Air handling equipment must be cleaned and maintained. Filter maintenance (cleaning or replacing) is the most critical procedure. The airflow and air quality into the hatchery is directly affected by the filtering system, which will keep airborne contamination out of the hatchery as well as keeping the equipment working properly. This maintenance should be performed regularly and dated.

Fogging is also an effective sanitation method. If fogging is used inside the incubators and hatchers, it is important that this is metered and timed so that it does not cause high humidity problems or the over-use of product which could settle on the eggs and upset the normal oxygen and carbon dioxide exchange. If fumigating, remember that fumigation only kills surface organisms; re-contamination can occur.

Water quality is extremely important in the hatchery especially on the humidifiers, inside rooms and incubators as they are each dependent on water to be effective. Some room humidifiers stay contaminated 100 percent of the time! These should be monitored and cleaned regularly. Test the water used in the hatchery with different disinfectants and use bacteria sensitivity plates to identify which products are most effective.

Bacteria are also introduced from condensation or wetting of the eggs. Contaminated eggs have a direct correlation with decreased hatch and high first week mortality. Condensation occurs when there is a sudden temperature change which affects the dew point. The critical times are when the eggs are unloaded at the hatchery or when the eggs are moved to the setter room for pre-warming. It is very important that when you pre-warm the eggs, there needs to be an adequate air flow though the eggs to remove moisture.

From cleaning to bacterial plate testing, all are essential components for effective sanitation. Establish a base line so that variations are detected early through a regular testing program and adjustments made quickly. This the only way to be sure of maintaining your chick quality day in, day out.

Understanding hatchery ventilation (part 1)

Getting the basics right for hatchery ventilation will help achieve a timely hatch, prevent bacterial contamination, ensure high chick quality, help to avoid ascites and contribute to healthy overall returns.

It is important to understand why the correct ventilation is so vital. An oxygen level of 19.6% by volume is integral to successful embryonic development, so providing an adequate air supply to the eggs while they are inside the machines is a top priority. While oxygen enters the egg through its porous shell, carbon dioxide escapes in the same manner.

A lack of oxygen adversely affects the hatch. As the developing embryo creates heat, it needs additional oxygen and must exhaust carbon dioxide. If the embryo is unable to dissipate this heat satisfactorily, it will develop too quickly, resulting not only in early hatch but also in dehydration and a high likelihood of mortality on the farm. Scattered hatching times reduce hatchery production.

With incorrect ventilation, the embryo experiences stress from the cold and there is impaired growth. There is slow development of the circulatory system and heart as well as reduced efficiency of the yolk.

When there is a lack of oxygen, ascites can occur in today's high-yielding birds at an early age due to decreased capillary flow. Clinical signs of ascites include an enlarged heart and muscle congestion. Fluid builds up in the bird's abdomen, and the heart grows in size from overwork. Regulating air volumes in the hatchery is the first step towards implementing a good ascites prevention program.

Pressure controls are excellent tools for attaining a positive pressure on the fresh air intake side of the machines and a neutral pressure on the exhaust sides, thereby preventing the development of micro-environments within the machines and the fresh air supply itself. This careful balance can deter bacterial contamination and ensure better overall chicken performance following hatch.

Every hatchery needs to pay careful attention to field performance. After hatching, it is crucial to move the chicks as quickly as possible into the brooding area and to give them water. Each and every chick needs to be robust and healthy on arrival at the farm. It is the earlier access to an adequate oxygen supply in the hatchery that is paramount for both the development of strong embryos and an on-time hatching process, giving the chicks the best opportunity to thrive.

How to achieve effective ventilation

The good news is that hatchery ventilation is not complicated as long as the system in place is properly designed, installed, monitored and controlled. For best effectiveness, the system must address the following:

- Air volumes to meet oxygen demand, even in high altitudes
- Pressure control throughout the hatchery
- Humidity control for good air quality
- Temperature requirements

Understanding hatchery ventilation (part 2)

AIR PRESSURE CONTROL

A successful ventilation program is measuring and monitoring pressure inside the fresh air plenum. The fresh air supply systems react to the needs of the hatchery environment from one moment to the next. Pressure controls regulate air movement and manage air volume supply in the hatchery.

Positive pressure in the fresh air plenum is an indicator that the available air supply surpasses that which the plenum demands. A neutral fresh air plenum means that the air supply and air demand are equal, with no air to spare should demand increases.

Pressure measurement to any area besides atmosphere requires a different approach when setting the controls. If the pressure for the exhaust plenum is measured to the fresh air plenum and the fresh air plenum is set at positive +.02 (inches H_2O), then the exhaust plenum control must be set to negative -.02 (inches H_2O) in order to maintain a neutral pressure 0.000.

A modern automated ventilation control system.

When the pressure is measured to atmosphere both in the exhaust and the fresh air plenums, the fresh air plenum should set at positive +.02 (inches H_2O) and the exhaust plenum should be set at neutral pressure 0.00. A variable speed fan and a pressure equalization device are required for controlling exhaust from designated areas.

An oxygen level of 19.6% by volume is the target for correct embryonic development, and air volume is the only acceptable source of oxygen for a hatchery. Therefore, a hatchery must not only provide adequate air volume to the eggs inside the machines but also air volume needs within different areas, including the incubators, hatchers and chick handling and holding areas.

While careful pressure control in a hatchery maintains bio-security of air movement by pushing air from clean toward dirty areas, it also ensures that air volume is available when machine demand increases. To create good air distribution within the machines, the table below shows both recommended pressure scales and air volume requirements for standard divisions within a hatchery.

Recommended pressure scales and air volume requirements by hatchery area

Room/Plenum	Air Exchange (cfm)	Pressures (inches H_2O)
Egg Holding	2.00 cfm per 1000 eggs	0.000 to +0.01
Incubator	8 cfm per 1000 eggs	+0.015 to +0.020
Hatcher	17 cfm per 1000 eggs	+0.005 to +0.01
Hallways	5 minute air exchange	Neutral 0.000
Dirty Pull	0.5 minute air exchange	-0.015 to -0.025
Chick Holding	40-60 cfm per 1000 chicks	0.000 to +0.005
All wash areas	0.5 minute air exchange	-0.015 to -0.025

Pressure conversion (0.01 inches H_2O = 2.5 Pascal's; 0.01 mbar; 0.1016 mmH_2O).

Air Exchange (1cfm, cubic feet per minute) = 1.69cmh, cubic metres per hour).

Understanding hatchery ventilation (part 3)

Satisfying the minimum oxygen level requirement for a hatchery can be more difficult when special circumstances, such as high altitude, apply. The answer is to increase the positive pressure in the fresh air supply area to funnel more air volume through the machines. Each type of machine has a maximum pressure level that also allows for an appropriate damper opening to accept an adequate air volume.

It is virtually impossible to obtain the 19.6% usable oxygen in the air at locations above 762 metres (2,500 feet).

No ventilation program is complete without providing eggs with a defence against moisture loss. During incubation, an egg loses water vapour through pores in the shell. Humidity and temperature are key factors in every egg's battle to stay hydrated.

When a hatchery applies water while the humidifiers are running, the temperature drops for as long as the humidifiers are in operation. In addition, running heaters will fight to maintain the pre-set temperature. Consequently, the humidifiers and heaters race against one another and ultimately increase the facility's energy expenses unnecessarily.

The best method for controlling relative humidity is through steam humidification, which uses the hatchery's air supply. By introducing steam in the room or fresh air supply duct, humidification occurs without a costly drop in temperature. Fresh air, when tempered by humidity and temperature, increases machine efficiency, fosters an ideal environment for embryonic development and meets air volume demand.

A delicate equilibrium among temperature, humidity and fresh air supply is necessary for protecting incubating eggs. The table below is a guide for temperature and humidity requirements for the various hatchery areas.

Temperature and humidity requirements by hatchery area

Room/Plenum	Temperature Range	Relative Humidity
Egg Holding Cooler	65 - 68°F (18 - 20°C)	65%
Incubator Room	75 - 80°F (24 - 27°C)	55%
Hatcher Room	75 - 80°F (24 - 27°C)	55%
Chick Holding	75 - 78°F (24 - 26°C)	70%

Guidelines for smooth ventilation system operation

1. *All of the internal as well as external doors must remain closed unless someone is passing through them.*
2. *The fresh air supply, air volume demand and exhaust must be balanced at all times.*
3. *A variable volume air supply (HVAC) and exhaust/recirculation volume must be available to assist with maintaining a dependable, consistent hatchery environment.*
4. *When natural chimney exhausts are used, the effects of the chimneys will vary drastically as the outdoor temperature changes. Mechanically controlled exhausts are a better alternative, so seasonal or temperature-related swings do not affect production.*
5. *Any variable speed fan that controls pressure in a room or plenum must have a good back draft shutter.*

In summary, good chick quality is the prerequisite for good broiler performance and attractive profit margins. Chick quality is directly related to good hatchery management. This depends on hatchery-wide pressure control, adequate air volumes for oxygen delivery and well-maintained humidity and temperature levels.

In a modern-day twist to the old conundrum "What came first?" the answer is neither the chicken nor the egg.....quite simply it's the correct ventilation.

Using the hatch window to assess hatch performance

The hatching of strong, viable chicks is a key factor for increased broiler performance. To increase the probability of strong birds, good hatchery management becomes critical. One hatchery management technique is to measure the hatch window.

The hatch window is an investigation to check the number of chicks hatched after the eggs have been transferred from the setter to the hatcher. If the eggs are hatching too early, the chicks become susceptible to problems such as dehydration. This could lead to higher 7 and 14 day mortality and /or poor broiler performance. If the chicks are hatching too late, the result could be poor hatchability, chick quality problems, increased pipped eggs and live embryo unhatched eggs.

A hatchery manager can set up the best schedule at different hours prior to chick pull to examine and count the number of chicks hatched. An example would be:

- 48 hours before pull.....7:00 am
- 43 hours before pull.....Noon
- 38 hours before pull.....5:00 pm
- 33 hours before pull.....10:00 pm
- 23 hours before pull.....8:00 am
- 13 hours before pull.....6:00 pm
- Day of pull.....7:00 am

Factors affecting early hatch include:

- Extended pre-heating periods
- Setting eggs too early
- Incorrect temperature and humidity settings
- Hot spots within the setter / hatcher
- Incorrect ventilation
- Seasonal temperature effects
- Egg size

Factors affecting late or delayed hatching include:

- Setting eggs too late
- Incorrect temperature and humidity settings
- Incorrect ventilation
- Eggs which have been stored for long periods
- Eggs stored at too low a temperature
- Incorrect setting patterns in multi-stage machines
- Disease or fertility problems

Ideally, no more than 25% of the total hatch should be hatched 23 hours prior to pull and more than 75% of the total hatch should be hatched 13 hours before pull.

The hatchery manager should be aware of the condition of the chicks at pull. Investigating the hatch window can help identify procedures that may need to be changed. It is essential information to understand what is happening with hatchery incubation.