APH508: HATCHERY TECHNOLOGY AND MANAGEMENT

BY DR L.T. EGBEYALE

Outlines

Incubation periods in Poultry species

Embryonic development and mortality

Sexing, brooding, marketing and management of chicks

Embryonic Development in chicken (EMBRYOGENESIS)

Fertilization occurs about 24 hours before the egg is laid. A sperm cell, actually a number of sperm cells, penetrates the blastodisc on the yolk, and a new life begins. When the egg is laid, the blastoderm contains several hundred cells. When the egg cools, embryonic development stops. Embryonic development starts again when the temperature is increased. If the temperature is then decreased to room temperature a second time, the embryo will die.

The first cleavage usually takes place in the isthmus after 5 hours of ovulation. **Cleavage** is a process of cellular division in the embryo without increase in the cytoplasm. Series of cleavage or division usually takes place in uterus and shell gland until 256 cell stage is reached, then there will be **Gastrulation**. Gastrulation is the movement of cells within the embryo to form the area of specific organs which usually called 3 germinal layers (Ectoderm, Mesoderm and Endoderm). These layers are definite organ forming region.

The first thing to be formed is usually the **brain** and **neural tissues** and it is usually within the first day. This occurs in incubator.

After 48 hours, the development of the heart, circulatory system and rudimentary gut (intestine) will occur.

After 72 hours, while the embryo is developing, temporary structures are formed to support life. They are called **extra-embryonic,** because they do not become a part of the embryo. The one that is visible at the earliest stage of development is the **amnion**.

Amnion: It looks like a small pool in which the embryo is floating. Its purpose is to protect the embryo.

The allantois is a structure that collects the waste that the embryo produces before it hatches. Many of the nutrients that the embryo needs are removed from the yolk by the yolk sac. Its blood vessels can carry nutrients from the yolk to the embryo.

The last structure is the **chorion**, which lies between the embryo and the shell. An important function is for it to exchange the carbon dioxide produced by the embryo and bring oxygen to the embryo. The chorion also is important for dissolving mineral from the shell and making it available to the chick for forming bones

The first 4 days are a time of dramatic change. Mistakes sometimes occur in this process. If it is a serious mistake, the defect is lethal and the embryo dies. In the incubation process, these mistakes cause "early deads." If the biological mistake is not as serious, the embryo may develop longer before dying, or it may survive with a congenital defect.

Each day of incubation, a developing embryo looks a little different. Some of the visible changes are listed in Table 1. Beginning at day 18, several major changes occur. One is that the embryo pokes its head through the inner membrane into the air cell, and then begins to breathe. It also takes any remaining yolk into its abdomen through the navel. The chick must then break out of its shell. These are major hurdles for the chick, and a number of chicks die before completing the tasks.

Table1**.** Stages of embryonic development in chicken.

Day	Feature
1	Brain and neural tissues
2	Blood vessels
3	Heart
6	Eye
8	Whole body
14	Small feathers
20	Yolk is internalized

Source: Marqand (1978)

Incubation Periods of some Poultry Species

Species	**Incubation Period (days)**
Domestic fowl	21
Turkey	28
Duck (Muscovy)	33-35
Duck (others)	28
Goose	29-31
Guinea fowl	26-28
Pigeon	16-20
Japanese quail	16-19
Pheasants	22-24
Ostrich	40-42

EMBRYONIC MORTALITY

Causes of Embryonic Mortality

There are 3 peaks of embryonic death
1. Between the 4th and 5th days due to transition from carbohydrate to protein as source of energy for the growing embryos. This is accompanied by accumulation of CO2, NH3 and C3H6O3 (lactic acid) if ventilation is very poor.
2. Between the 14th and 15th days of incubation- associated with riboflavin (vitamin B_2- $C_{17}H_{20}N_4O_6$) deficiency
3. between the last 3 days of incubation- due mainly to mismanagement of the hatching eggs

Embryonic mortality has to do with the death of embryo at various stages of development. The early embryonic mortality is called **dead-in-germ** while late embryonic mortality is called **dead-in-shell.**

Causes of dead-in-germ
» Deformed spermatozoa- low sperm count, infertile sperm

» Nutritional problem- deficiency of Vit.B complex in the ration of breeder.

» Improper/inadequate turning of eggs in the incubator.

» The condition of the incubator with particular reference to temperature (low or high), humidity (low or high, accumulation of CO2, lactic acid, NH3 as a result of gasses produced by the egg when there is no adequate ventilation)

Causes of dead-in-shell
» Inadequate turning

» Mal-positioning of the embryo. Normal position of embryo is that head should be positioned to broad end so that it will use its beak to tear off the air space membrane thereby breath in the first air in the air space. Any position apart from this is mal-positioning.

» The thickness of egg shell – it causes mortality because atimes chick may not strong enough to break the shell.

» Deficiency of Vit. B complex (Nutritional problem)

» Twinning- this can cause mortality because the twin in the egg will be competing for the nutrient and be unable to break the shell because of their weakness.

» The condition of the incubator and hatcher (temperature, humidity, ventilation)

» Contamination of the hatching egg (egg condition)

» Time taking during the fertility test- wasting of time from incubator to candling room to hatcher leads to loss of temperature and humidity from the eggs.

» Improper handling during the candling.

Sexing of day-old chicks

Sexing of day-old chicks is done to determine the gender of the chicks i.e the differentiation of the sex of the birds into male and female. In avian, the spermatozoa are homogametic. The chromosomes are the same i.e. they carry the W-chromosome. In case of the female, the chromosomes are heterogametic because they carry Z-chromosome. In other words, it is the female that determines the sex of the chicken in avian. In most cases, more than 50% in chicken hatched are males.

Methods of sexing Day-old chicks

There are two main methods of sexing chicks:

1. Sexing before hatching

2. Sexing after hatching

Sex before hatching: This involves the use of molecular markers to detect the chromosomes that are present in the embryonic cells of the amniotic and allantois fluid. The advantages are; it helps to be sure of sex that will be hatched. It saves times. The disadvantages are; cumbersome and very expensive.

Sexing day-old chicks can be accomplished by one of two methods: 1) vent sexing or 2) feather sexing. Each method has difficulties that make it unsuitable for use by the small flock owner. Vent sexing rely on the visual identification of sex based on appearance of sexual organs. Feather sexing is based on differences in feather characteristics at hatch time. A brief explanation of each method is as follows.

Vent sexing of chicks at hatching has complications that make it more difficult than sex determination of most other animals. The reason is that the sexual organs of birds are located within the body and are not easily distinguishable.

The copulatory organ of chickens can be identified as male or female by shape, but there are over fifteen different shapes to consider. Therefore, few people have experience with determining the sex of birds because of the difficult nature of the process. Most of these highly trained individuals are employed by large commercial hatcheries. The training to be a chick sexer is so difficult and lengthy that the average poultry owner finds it unjustifiable.

Feather sexing is based on feather characteristics that differ between male and female chicks. The method is very easy to learn by the poultry man, but the feather appearances are determined by specially selected genetic traits that must be present in the chick strain. Most strains (breeds) of chickens do not have these feather sexing characteristics and feathering of both sexes appear identical.

Brooding and Chick Management

Brooding is the care of the chick from one day old to six weeks of age. It consists primarily of the provision of heat, air, water and feed. It is the efficient combination of these factors that determines the level of physical and physiological development and the mortality of the chicks. The mortality of the chicks during this period should normally not exceed **5%.**

No amount of care can convert a potentially poor chick into a good one. The performance of the fowl, especially in terms of growth rate, depends partly on whether it originates from slow or fast-growing strains. Apart from this, the chick should be of sound constitution and therefore, should have parents that are free from egg-transmissible or heritable diseases. Examples of these diseases are fowl typhoid, pullorum and epidemic tremor.

Ensure that the brooding house and other equipment are cleaned and disinfected before the arrival of the chicks. Light the brooders 24 hours before the chicks hatch or arrive. Place an adequate number of feeders (a flat feeder or egg tray and a 0.6m long trough feeder are assigned to 100 chicks allowing 2.5cm feeding space per chick) and waterers around each brooder. Provide at least two 1-gallon waterers and two 12-inch or 18-inch chick feeders for every 100 chicks.

The day-old chick's temperature is about 3 °F below that of an adult's. Its body temperature starts rising about 4 days of age and reaches its maximum at 10 days. The chick needs time to develop temperature control (2 to 4 weeks). As the chick grows older, the downy coat is replaced with feathers, and brooder temperature must be reduced according to the temperature schedule.

Under this brooding schedule, the optimum temperature recommended for brooding are 32.2 - 35^{o}C, 29.7-32.2^{o}C and 26.29-29.7^{o}C for the first, second and third weeks of brooding respectively. Alternatively, brooding may start with 32.2^{o}C for pullets or 35.0^{o}C for broiler chicks and be reduced by about 0.16^{o}C per day until ambient temperature is attained.

Check the comfort of the chicks several times each day, especially in the evening. Make adjustments to maintain chick comfort. Contented peeping and even distribution of chicks around and under the brooder indicate comfortable conditions. If the chicks chirp and huddle to one side of the brooder, there is a draft. When the temperature is too cold, the chicks chirp sharply and huddle together under the brooder. If the chicks move away from the brooder, pant, and are drowsy, the temperature is too warm.

Vaccination

Vaccination is an effective means to prevent and/or reduce the adverse effects of specific diseases in poultry.

Marek's disease vaccine is usually administered to chickens at the hatchery on the day of hatch. It is given subcutaneously (under the skin) at the back of the neck. It is best to order chicks already vaccinated at the hatchery.

Chicks are often vaccinated at the hatchery against Newcastle disease and infectious bronchitis with a combination vaccine. The combination Newcastle-Infectious Bronchitis vaccine can also be given at 10-35 days. The vaccine can be administered via the drinking water, intraocular route or intranasal route.

Hatchery Technique & Management - APH508 (By Dr. O.M. Sogunle)

Introduction- Fertility & Hatchability

The words "fertility" and "hatchability" are often used incorrectly by small producers. These terms are important and have very important meaning.

Percent Fertility is the percentage of fertile eggs of all eggs produced.

$$\% \text{ fertility} = \frac{\text{\# of fertile eggs}}{\text{\# of total eggs produced or set}}$$

Percent Hatchability is the percentage of fertile eggs which actually hatch out as live young.

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Care of Hatching Eggs

Before setting eggs in an incubator, you must obtain or produce quality fertile eggs from a well-managed, healthy flock which are fed properly balanced diets.

1. Keep the nest full of clean, dry litter. Collect the eggs early in the morning and frequently during the day to prevent excessive chilling or heating of the eggs.

2. DO NOT wash eggs unless necessary. If it is necessary to wash eggs always use a damp cloth with water warmer than the egg. This causes the egg to sweat the dirt out of the pores. Never use water cooler than the egg. Also, do not soak the eggs in water. If the egg is allowed to soak in water for a period of time, the temperature difference can equalize and bacteria has a greater chance of entering through the pores. Be sure eggs are dry before storing. Never place damp or wet eggs in a styrofoam carton for storage.

3. Store the clean fertile eggs in an area which is kept at 55°- 60°F and 70-75% humidity. Never store eggs at temperatures about 75°F and at humidities lower than 40%. These conditions can decrease hatchability dramatically in a very short period of time. Slant or turn the fertile eggs daily while they are being stored. Store the eggs small end down and slanted at 30-45 degrees. Putting a piece of 2" x 4" under one end of the carton or storage container and changing it to the other end daily works well. Do not store eggs for more than 10-14 days. After 14 days of storage, hatchability begins to decline significantly.

4. Just before setting the eggs, allow them to warm to room temperature (70-80°F) and remove any cracked eggs.

Incubation

Four factors are of major importance in incubating eggs artificially: temperature, humidity, ventilation and turning. Of these factors, temperature is the most critical. However, humidity tends to be overlooked and causes many hatching problems. Extensive research has shown that the optimum incubator temperature is 100°F (37.8^0C) when relative humidity is 60 percent. Concentrations of oxygen should be above 20 percent, carbon dioxide should be below 0.5 percent, and air movement past the egg should be 12 cubic feet per minute. There are two types of incubators commonly used:

1. Forced-air incubators which have a built in fan to circulate the air.
2. Still-air incubators which have no fans, so the air is allowed to stratify.

The forced-air incubator should be set at 99-99.5°F and 60-65% relative humidity (83-88°F wet bulb). The advantage of the forced-air incubator is that it is easier to maintain humidity at a constant level because of air circulation.

Still air incubators are smaller and air flow is harder to manage. Set still-air incubators at 100 to 101°F at egg height. This is important since the air stratifies in these incubators. There can be as much as a 5° difference in temperature from the top to the bottom of some of the still-air incubators. Humidity should be 60-65% (80-90° wet bulb) during incubation and 70-75% (92-97° wet bulb) at hatching time. It is very easy to overheat the eggs in still-air incubators and difficult to maintain proper humidity. ***It should be noted that the various incubators (dependent on size and source of power) that exist could either be still-air or forced air incubator.***

Temperature

During the warm-up period, the temperature should be adjusted to hold a constant 101°F for still air, 99°-100°F for forced air. To obtain reliable readings, the bulb of the thermometer should be at the same height as the tops of the eggs and away from the source of heat. Using two thermometers is a good idea to ensure you are getting an accurate reading.

Incubator temperature should be maintained between 99° and 100°F. The acceptable range is 97° to 102°F. Mortality is seen if the temperature drops below 96°F or rises above 103°F for a number of hours. If the temperature stays at either extreme for several days, the eggs may not hatch. Overheating is more critical than underheating. Running the incubator at 105°F for 15 minutes will seriously affect the embryos, while running it at 95° for 3 or 4 hours will only slow the chick's metabolic rate.

An incubator should be operated in a location free from drafts and direct sunlight. An incubator should also be operated for several hours with water placed in a pan to stabilize its internal atmosphere before fertile eggs are set. Do not adjust the heat upward during the first 48 hours after eggs are set. This practice cooks many eggs. The eggs will take time to warm to incubator temperature and many times in small incubators the incubator temperature will drop below 98°F for the first 6-8 hours or until the egg warms to 99°-100°F.

In Case of Power Outage

If you experience a power failure, do not scrap the hatch. Most of the time the hatch can be saved. The key is to keep the eggs as warm as possible until the power returns.

This can be done by placing a large cardboard box or blankets over the top of small incubators for

additional insulation. To warm the eggs, place candles in jars, light them and place the jars under the box that covers the incubator. Be careful not to put any flammable material closer than a foot from the top of the candles. The heat from the candles can easily keep the eggs above 90°F until the power returns.

Embryos have survived at temperatures below 90°F for up to 18 hours. You should continue to incubate the eggs after the outage; then candle them 4 to 6 days later to check for further development or signs of life. If, after 6 days, you do not see life or development in any of the eggs, then terminate incubation. Most of the time, a power outage will delay hatching by a few days and decrease the hatchability to 40-50 percent.

Humidity

The relative humidity of the air within an incubator should be about 60 percent. During the last 3 days (the hatching period) the relative humidity should be nearer 65-70 percent. (Too much moisture in the incubator prevents normal evaporation and results in a decreased hatch, but excessive moisture is seldom a problem in small incubators.) Too little moisture results in excessive evaporation, causing chicks to stick to the shell, remain in the pipped shells, and sometimes hatch crippled.

The relative humidity in the incubator can also be varied by changing the size of the water pan or by putting a sponge in the pan to increase the evaporative surface. The pan should be checked regularly while the incubator is in use to be sure that there is always an adequate amount of water. Adding additional water pans to small still-air incubators is also helpful to increase humidity.

During the hatching period, the humidity in the incubator may be increased by using an atomizer to spray a small amount of water into the ventilating holes. (This is especially helpful when duck or goose eggs are hatching.)

Whenever you add water to an incubator, it should be about the same temperature as the incubator so you do not stress the eggs or the incubator. A good test is to add water just warm to the touch.

Using a wet-bulb thermometer is also a good way for determining relative humidity. The wet-bulb thermometer measures the evaporative cooling effect. If the wet and dry bulb read the same temperature, you would have 100 percent humidity. The greater the evaporation taking place, the lower the temperature reading on the wet-bulb thermometer and the larger the spread will be between the wet- and dry-bulb readings.

To make a wet-bulb thermometer, just add a cotton wick to the end of a thermometer. Then place the tail of the wick in water. The cotton then absorbs the water. As the water evaporates from the cotton it causes a cooling effect on the thermometer.

The table below (Relative Humidity) will enable you to calculate relative humidity using readings from a wet- bulb thermometer and the incubator thermometer.

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Percent Relative Humidity	45%	50%	55%	60%	65%	70%

(From Egg to Chick, Northeast State Cooperative Extension Service)

Ventilation

The best hatching results are obtained with normal atmospheric air, which usually contains 20-21 percent oxygen. It is difficult to provide too much oxygen, but a deficiency is possible. Make sure that the ventilation holes are adjusted to allow a normal exchange of air.

This is critical on home-made incubators. It is possible to suffocate the eggs and chicks in an air-tight container. However, excessive ventilation removes humidity and makes it difficult to heat incubators properly.

Turning

Eggs set on their sides must be rotated 1/2 turn at least 3 times daily. Eggs set with the air cell end up should be tilted in the opposite direction 3 times daily. This keeps the embryo centered in the egg and prevents it from sticking to the shell membrane. If hand turning, to insure proper turning, mark each side of the egg with a pencil. Put an "x" on one side and an "o" on the opposite side.

Stop turning the eggs for the last three (3) days of the incubation cycle (at 18 days for chickens, 25 days for waterfowl, etc.) and do not open the incubator until the hatch is completed to insure that a desirable hatching humidity is maintained.

Hatch Time

Do not help the chicks from the shell at hatching time. If it doesn't hatch, there is usually a good reason. Also, prematurely helping the chick hatch could cripple or infect the chick. Humidity is critical at hatching time. Don't allow your curiosity to damage your hatch.

As soon as the chicks are dry and fluffy or 6 to 12 hours after hatching, remove the chicks from the incubator. It is good practice to remove all the chicks at once and destroy any late hatching eggs. Hatching time can be hereditary and you can control the uniformity of hatching by culling late hatchers. If you keep every chick which hatches late, in a few years each hatch could last 4 days or longer.

Sanitation of Incubator and Equipment

No matter what type of incubation you use, it is important that you thoroughly clean and disinfect the incubator before and after you use it. It is just as important that the incubation room and egg storage area are kept equally clean. The lack of sanitation will decrease hatchability.

Immediately after each hatch, thoroughly clean and disinfect all hatching trays, water pans and the floor of the hatcher. Scrape off all egg shells and adhering dirt. Wipe clean surfaces thoroughly with a cloth dampened in quaternary ammonium, chlorox or other disinfectant solution.

Incubation Periods of Other Species

One of the miracles of nature is the transformation of the egg into the chick. In a brief three weeks of incubation, a fully developed chick grows from a single cell and emerges from a seemingly lifeless egg.

Incubation Periods (species and days required to hatch)

Bobwhite Quail	(23-24)	Guinea	(27-28)
Chicken	(21)	Muscovy Duck	(35)
Chukar Partridge	(23-24)	Pheasants	(24-26)
Coturnix Quail	(16-18)	Ostrich	(42)
Ducks	(28)	Swan	(35)
Geese	(28-33)	Turkey	(28)

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Sanitation of Incubator and Equipment

No matter what type of incubation you use, it is important that you thoroughly clean and disinfect the incubator before and after you use it. It is just as important that the incubation room and egg storage area are kept equally clean. The lack of sanitation will decrease hatchability.

Immediately after each hatch, thoroughly clean and disinfect all hatching trays, water pans and the floor of the hatcher. Scrape off all egg shells and adhering dirt. Wipe clean surfaces thoroughly with a cloth dampened in quaternary ammonium, chlorox or other disinfectant solution.

Incubation Periods of Other Species

One of the miracles of nature is the transformation of the egg into the chick. In a brief three weeks of incubation, a fully developed chick grows from a single cell and emerges from a seemingly lifeless egg.

Incubation Periods (species and days required to hatch)

Bobwhite Quail	(23-24)	Guinea	(27-28)
Chicken	(21)	Muscovy Duck	(35)
Chukar Partridge	(23-24)	Pheasants	(24-26)
Coturnix Quail	(16-18)	Ostrich	(42)
Ducks	(28)	Swan	(35)
Geese	(28-33)	Turkey	(28)

HATCHERY TECHNOLOGY AND MANAGEMENT (Dr (mrs.) Sanwo)

Care and Incubation of Hatching Eggs

- **Selection of Hatching Eggs**
- **Egg Care and Storage**
- **Incubators**
- **Incubating Conditions**
- **Sanitation**
- **Troubleshooting Failures**

Selection of Hatching Eggs

- Select eggs from breeders that are (1) well developed, mature and healthy; (2) compatible with their mates and produce a high percentage of fertile eggs; (3) are not disturbed much during the mating season; (4) fed a complete breeder diet; and (5) not directly related [brother, sister, mother, father, etc.].
- Avoid excessively large or small eggs. Large eggs hatch poorly and small eggs produce small chicks.
- Avoid eggs with cracked or thin shells. These eggs have difficulty retaining moisture needed for proper chick development. Penetration of disease organisms increase in cracked eggs.
- Do not incubate eggs that are excessively misshapen.
- Keep only clean eggs for hatching. Do not wash dirty eggs or wipe eggs clean with a damp cloth. This removes the egg's protective coating and exposes it to entry of disease organisms. The washing and rubbing action also serves to force disease organisms through the pores of the shell.

Egg Care and Storage

- Collect eggs at least three times daily. When daily high temperatures exceed 85 degrees F. increase egg collection to five times daily. Collect two or three times in the morning and one or two times in the afternoon.
- Slightly soiled eggs can be used for hatching purposes without causing hatching problems, but dirty eggs should not be saved. Do not wash dirty eggs.
- Store eggs in a cool-humid storage area. Ideal storage conditions include a 55 degree F. temperature and 75% relative humidity. Store the eggs with the small end pointed downward.
- Alter egg position periodically if not incubating within 4-6 days. Turn the eggs to a new position once daily until placing in the incubator.
- Hatchability holds reasonably well up to seven days, but declines rapidly afterward. Therefore, do not store eggs more than 7 days before incubating. After 3 weeks of storage, hatchability drops to almost zero. Plan ahead and have a regular hatching schedule to avoid storage problems and reduced hatches.
- Allow cool eggs to warm slowly to room temperature before placing in the incubator. Abrupt warming from 55 degrees to 100 degrees causes moisture condensation on the egg shell that leads to disease and reduced hatches.

Incubators

The size and type of incubator selected depends on the needs and future plans of each producer.
There are basically two types of incubators available, forced-air and still-air incubators. Forced-air incubators have fans that provide internal air circulation. The capacity of these units may be very large. The still-air incubators are usually small without fans for air circulation. Air exchange is attained by the rise and escape of warm, stale air and the entry of cooler fresh air near the base of the incubator. Recommended temperatures vary between the two incubators, so follow the manufacturer's recommendation that accompany the units.

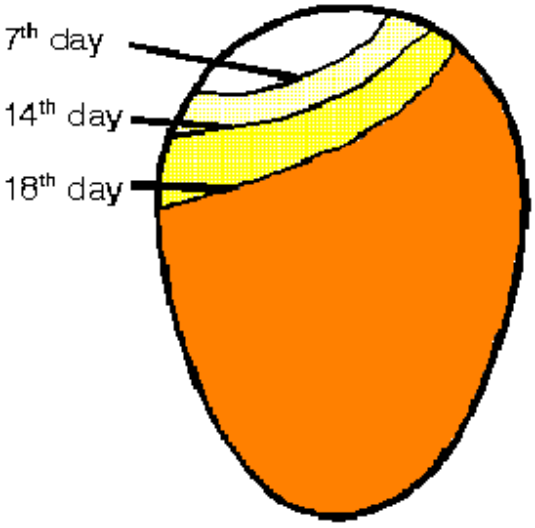
Incubating Conditions

Poor results are most commonly produced with improper control of temperature and/or humidity.

- Poor results also occur from improper ventilation, egg turning and sanitation of the machines or eggs.
- Maintain a still-air incubator at 102 degrees F. to compensate for the temperature layering within the incubator.
- If the eggs are positioned in a vertical position, elevate the thermometer bulb to a point about ¼- to ½-inch below the top of the egg. The temperature is measured at the level where the embryos develop (at the top of the egg). Do not allow the

thermometer's bulb to touch the eggs or incubator. Incorrect readings will result.

- Humidity is carefully controlled to prevent unnecessary loss of egg moisture. The relative humidity in the incubator between setting and three days prior to hatching should remain at 58-60% or 84-86 degree F., wet-bulb. When hatching, the humidity is increased to 65% relative humidity or more.



Size of air cell on 7th, 14th and 18th day of incubation

EGG ABNORMALITY

TOO LARGE AND TOO SMALL EGGS- Leads to INTERNAL EGG DEFORMITIES

DOUBLE YOLK EGGS:

Double Yolkers appear when ovulation occurs too rapidly, or when one yolk somehow gets "lost" and is joined by the next yolk. Double yolkers may be by a pullet whose productive cycle is not yet well synchronized. They're occasionally laid by a heavy-breed hen, often as an inherited trait.

NO YOLK:

No-yolkers are called "dwarf", "wind" [or, more commonly, "fart"] eggs. Such an egg is most often a pullet's first effort, produced before her laying mechanism is fully geared up. In a mature hen, a wind egg is unlikely, but can occur if a bit of reproductive tissue breaks away, stimulating the egg producing glands to treat it like a yolk and wrap it in albumen, membranes and a shell as it travels through the egg tube.

MORE THAN TWO YOLKS:

Occasionally, an egg contains more than two yolks. I once found a pullet's egg that contained three. The greatest number of yolks found in one egg is NINE. Record breaking eggs are likely to be multiple yolkers. The Guinness Book of Records lists the

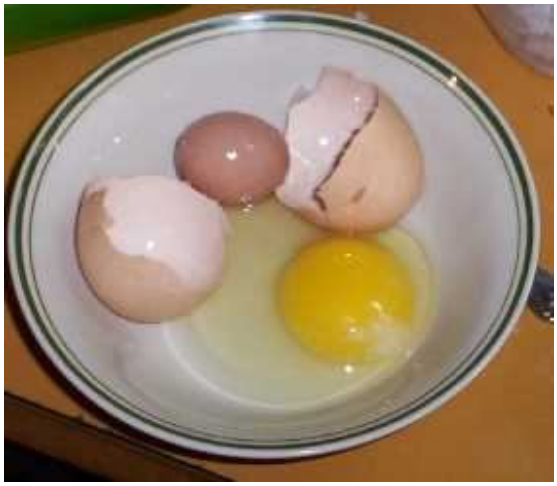
world's largest [chicken] egg (with a diameter of 9 inches / 22.5 cm) as having five yolks and the heaviest egg (1 pound / 0.45 kg) as having a double yolk and a double shell.

NO SHELL

Every once in a while we get an egg with a membrane, but without a shell. It feels like a water balloon. This is another accident of the hen's reproductive system and is not necessarily an indication of any problem

EGG WITHIN AN EGG:

An egg within an egg, or a double shelled egg appears when an egg that is nearly ready to be laid reverses direction and gets a new layer of albumen covered by a second shell. Sometimes the reversed egg joins up with the next egg and the two are encased together within a new shell.



Another example:

EXTERNAL EGG ABNORMALITY
ODD SHAPED EGGS
This happens from time to time and is just an "accident". The long, thin egg below was laid by one of our Barred Rock hens in June, 2004. It is over 2 1/2 inches long and less than 1 1/4 inches across the middle.

VERY ODD SHAPED EGGS!:

Hen Produces Spoon-Shaped Egg - from www.ananova.com (UK online news service)
31 January 2005

A spoon-shaped egg, 8.5 centimeters long and 35 grammes in weight.

WORMY EGGS:

Wormy eggs are extremely rare, occurring only in hens with a high parasite load. Finding a worm in an egg is not only unappetizing, but is a clear indication that you are not doing a good job in keeping your hens healthy and parasite-free.

SHELL DISCOLORATION:

This is fairly common and occurs most often in brown eggs. The pigment is sometimes deposited on the egg unevenly during production resulting in one end being a light tan and the other a darker brown. The large end usually has the darker color. The deposit of the pigment rarely forms a recognizable pattern (like seeing shapes in clouds), but click HERE for more info about the happy face egg we found laid here on 6 August 2000.

BLOOD SPOTS:

See this page for information on blood or meat spots in eggs.

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EGG CANDLING

Is necessary to candle eggs for fertility when you are incubating eggs artificially using an incubator. Infertile or bad eggs can be discarded so that there is no risk of them going bad and exploding inside the incubator, contaminating the other eggs and if you are using a separate incubator or hatcher for the last few days of incubation to hatch your eggs, the extra space can be used for more eggs. Candling does not damage the embryos inside the eggs as long as you don't heat the egg up too much with the heat from the candling device.

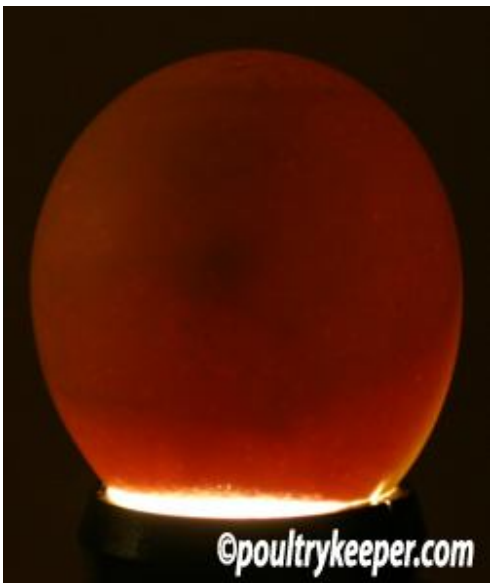
Candling gets its name from days gone by when people used to use candles as the light source of course these days, you can buy or make your own candler using a light bulb as the light source. The cheapest way to create a DIY candler is to place a light bulb (low energy light bulbs are best as you can get a very bright bulb that doesn't generate as much heat as a conventional bulb) and light fixture inside a cardboard box. Cut a small, round hole in the top of the box, just big enough to sit the pointed end of your egg into. Place your egg onto this hole and turn the light on. You should be able to see what is inside the egg and with practice you will be able to identify fertile eggs by the spider-like blood veins spreading out much like a spider's legs, bad eggs (sometimes called dead germs) where the embryo starts to develop but later died and infertile eggs that are clear except for the shadow of the yolk.

Dark shelled eggs are much harder to see through so you will need the brightest light source you can get and if you still can't tell, you will have to wait longer until the embryo has developed further and can be seen more easily.
Eggs are normally tested after 5 to 7 days of incubation. The most critical period of incubation during the development of the embryo is the first week so it is best to be patient and only take a look after the first week. You will see more after a week and can be more certain about the fertility.

Here are some photos of candling eggs which will help you to know what to look for.

Candling an Infertile Egg.

The Yolk can't be seen as it is the opposite side but can sometimes be seen as a dark cloud towards the center of the egg.



Candling a Fertile Egg. Day 8.

The Embryo is the dark patch in the center, blood vessels can also be seen. Notice the air sack at the top

ESTABLISHMENT OF HATCHERY

BY Prof. S.S. Abiola

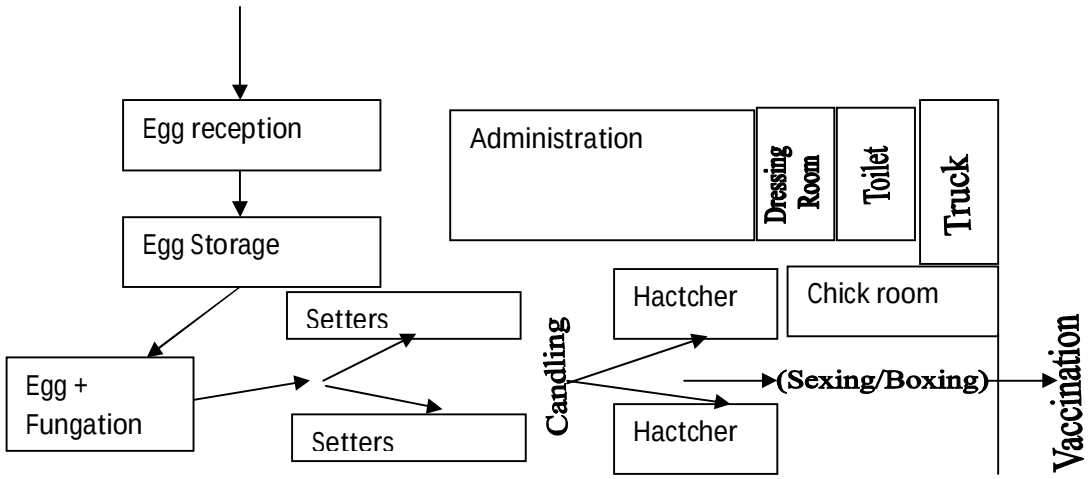
The hatchery is the building where machines (e.g. fumigators, setters, hatchers etc.) and appliances are installed for the production of day-old-chicks.

The plan for the hatchery is dictated by the following considerations:

(a) **Room Temp**: -Should be 21^{o}C in the incubator room for best results. This may involve the use of air-conditioners. However, if this is un-economical, the building should be constructed to allow straight through ventilation e.g. using fans.

(b) **Space**:-Incubator room should be spacious and provide opportunity for expansion e.g. no. of setters may be increased from 2 to 3 in the future, fumigators may be increased from 3 to 5 in the future etc.

(c) **Work-Flow**: - The arrangement of rooms should make for efficient work-flow e.g. Auxillary rooms (e.g. tray, box or dressing rooms) should be located conveniently to support the main flow.



MACHINES AND APPLIANCES OM THE HATCHERY

1. **Fumigators**: - Equipment used for fumigation of eggs to prevent, transmission of diseases like CRD salmonellosis to the eggs which may kill the embryos. $KmnO_4$ and formaline can be used at ratio of 1:2 i.e. 20g/40cc for 30 mins. Pour formaline on top of $KMnO_4$ OR 1gm $KMnO_4$ to 1.50gm formaline for $1m^2$ space.

2. **Setters**:- Fumigated eggs are stored here for 18 days at temp of 37^oC (99. 7^oF) and Humidity of 50-60%. Here eggs are turned on hourly basis. Eggs are kept inside egg trays with broad ends up.

3. **Egg Candler**:- For fertility test.

4. **Hatchers**:- Hatchable eggs are stored here as from the 18^{th} day for 3 days.

TYPES OF INCUBATOR

1. **Table-top incubator**:-

2. **Forced or Cabinet type incubator**:-Has separate setter and hatcher. Available in different sizes e.g. Westem and Petersime incubators.

MANAGEMENT OF BREEDERS

Primary breeding, parent breeder production and multiplication for the production of egg or meat-strain day-old commercial chicks, poults, duckings etc depend on the hatching process. However, the fertility of eggs will depend on the following factors in the management of breeders.

(1) **Nutrition**:- Deficiencies of vitamins A & E can affect spermatogenesis. Defency of some Vit. B Complex results deformity of embryos at different stages of development.

(2) **Mating Ratio**:- To prevent premature mating, males and females can be managed separately till maturity during which time a mating ratio of 1:8 (large strain) or 1:10 (light strain) can be used. However, guinea fowls & pigeons are monogamous and can always exhibit mating behaviour particularly during courtship.

NOTE:- Mating behaviour e.g. in guinea fowl and pigeons which are monogamous.

During courtship, male pigeon displays his attractive plumage to the female e.g. by DANCING. After courtship period, mating follows.

(3) **Age of breeders**: - Over 1 year declines libido in male and ability to retain calcium declines in female.

(4) **Environmental Temp**: - Causes depression in feed intake leading to depression in feed efficiency, reduction in frequency of mating, quantity and quality of semen e.g. deformed spermatozoa, low sperm count, etc.

(5) **Health of Breeders**: -e.g. vaccinations and necessary medications from day-old to maturity to be given to avoid trans-ovarian diseases in hens, e.g. vaccination against NCD using NDV (1/o), NDV (k) at different ages (details to be discussed).