Embryonic Development and Hatchery Management

AgScience Poultry Science Curriculum
Chapter.6
Introduction

A well run hatchery is critical for any integrated poultry company
Directly impacts profitability
Hatch of fertile
Chick quality

Automated hatchery equipment drastically improved production efficiency
One factor that has lead to improvement in production poultry genetics

Many commercial hatcheries are completely automated and advancements ...

Egg supplies all needs of chick – nutrition protection etc
In many ways mimic the way hen would treat eggs in nest
Hatching Eggs – Role of the Breeder Farm

At the breeder farm:
Eggs unsuitable for hatching should be removed

PICTURES OF UNSUITABLE HATCHING EGGS

Eggs packed on incubator trays or cart
Often eggs will not be handled again
Big end up!
Chick needs to develop with head near air cell
If egg placed in tray with big end down hatchability can be decreased approximately 10%

PICTURES OF CARTS ON FARM STORAGE??

On farm egg storage conditions:
Temperature – 65oF
Humidity – 75%
Must prevent dehydration prior to incubation
On farm no more than 2 to 3 days
Pick up eggs from farm 2 times per week
Embryonic Development

Embryo development can be broken into 2 phases

**Phase 1** – Occurs in hens body prior to oviposition
4.5% of embryonic development
1st cell division 3 hr post-fertilization

**Phase 2** – After oviposition if conditions are correct
Temperature above 70 ¾°F
Collect eggs timely and get into on-farm cooler

In a fertile egg there are 3 additional embryonic membranes
- **Allantois** – Breaks down albumen, aids in Ca absorption, storage of excretory products
- **Chorion** – Fuses with allantois and shell, produces carbonic acid releases Ca from shell, weakens shell
- **Amnion** – Surrounds and protects embryo
Embryonic Development
Hatchery Responsibilities

Primary hatchery responsibilities

Fertile Egg
- On-farm pick-up
- Transportation
- Incubation
- Hatching

Chick
- Processing
- Vaccination
- Counting
- Holding
- Delivery
Flow of eggs through hatchery

Clean → Dirty

In a commercial hatchery even air flow is controlled
Positive pressure in clean rooms – air pushed out

Unloading dock → Egg Storage → Incubation → In-ovo Vaccine

Loading → Holding → Chick Storage → Hatchers
Egg Storage

Egg Storage is critical for maintaining viable embryos

During storage temperature of eggs should not exceed 58-64.25°F
- Maintain temperature towards high end could reduce sweating when begin incubation
  - Sweating can reduce air exchange
  - Could cause cross-contamination

Relative humidity should be maintained around 60-70%
- RH control maintains rate of moisture loss through shell membranes and pores
Incubator (Setter)

In the incubator the majority of embryo development will occur in many ways attempted to mimic nature and the way hen would care for eggs:

- Chicken eggs in incubator days 1-19
- Turkey eggs in incubator days 1-25

Egg Rotation

- Commonly done 1 time/hour
- At least 6-8 times/day
- Prevents embryo from sticking as albumen thins

Temperature

- Chicks – 98.6oF – 102.4oF
- Poults – 97.8 – 99.2oF
- Sometimes hatchery dependent

Embryos have low tolerance for temps over 104oF; particularly towards end of incubation.

- For short time is ok
- Prolonged will decrease hatchability, and increase abnormal chicks

Relative humidity

50-60%

Too low – chick losses too much moisture
Too high – chick losses too little moisture

Egg should loss 10.5-12% moisture during incubation.
Incubator – Measuring Relative Humidity

Monitoring temperature and relative humidity throughout incubation is critical.

Temperature is measured using the dry bulb temperature
- Thermometer in the incubator.

Relative humidity is measured at the intersection of the dry bulb temperature and the wet bulb temperature on psychometric chart
- Wet bulb temperature – temperature of bulb immersed in water.

Insert chart excerpt

Setters display the wet bulb temperature
- Dry bulb temperature 97-100oF
- Wet bulb temperature 79-80oF
- RH – 50-60%
Hatcher

At transfer, eggs will be moved to hatching trays
At commercial hatcheries this is done automatically using machines with suction cups

Egg Rotation
- No longer required in the hatcher
- Chick is covered with feathers and sticking is no longer a concern

Temperature
- Remains important
- Chicks particularly sensitive to high temperatures

Relative Humidity
- Should increase in the hatcher
- Chicks – 75%
- Poults – 80-85%
- Aid in shell softening and ease in chick hatching
Air Quality

Air exchange across the shell as the embryo grows
- Oxygen absorbed through shell pores and membranes
- Embryos producing CO2 through normal metabolism
- Controlling CO2 critical

In the hatcher air quality is most important
- Lots of fresh air required for hatching (physically demanding!)
- 1% drop in O2 in hatchery = 5% drop in hatchability!
- During hatching chicks will pip through the air cell to get first breath of fresh air to continue hatching
Chick Sorting and Processing

Not all of eggs set in the incubator will hatch
  Un-hatched eggs as well as empty shells must be separated from live chicks

Most hatcheries use automatic sorting machines

Insert picture

Chick counting and processing is completed with a combination of automatic machinery and manual labor
  Broiler hatcheries much more automated than turkey hatcheries

Chick processing procedures: INSERT PICTURES
  Vaccinating
  Toe-trimming
  Beak conditioning
  Sexing
  Company and bird-use dependent
Chick Holding

Chicks counted and placed in boxes
100 chicks/box
Moved to heated storage area to await delivery to grow-out farms

PICTURES OF CHICK BUSES ETC

Climate controlled vehicles used to transport chicks to farms
Chick busses
Hatchery Quality Control

True fertility – refers to the number of eggs that are fertile at the point of oviposition
- Used for evaluating breeder flock performance or inseminating crew efficiency

True fertility is evaluated between 10 and 12 days of incubation
- Eggs candled; developing embryo will be evident
- Early dead is the term used to describe eggs that don’t appear to be developing at this point in incubation
- Clear eggs must be broken open to distinguish between early dead and infertile

INSERT PICTURE – Fertile/infertile/early dead

True fertility = # of fertile eggs/# of eggs set *100
Should ideally be 96%
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Hatchery Quality Control

Hatchability is the measure of most importance to the hatchery
Direct measurement of hatchery performance
Can be effected by many factors
Most fertile eggs brought to the hatchery should hatch
Low hatchability can indicate problems with incubator, hatcher conditions

Hatchability can be expressed as a percentage of total eggs set OR fertile eggs set

Hatch of fertile = # of eggs that hatched / # of fertile eggs set

Hatchability = # of eggs hatched / # of eggs set

Ideal hatchability – 86%
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Ideal hatchability – 86%
Hatchery Quality Control

Other factors affecting hatchability
  
  Extended egg storage time – beyond 5 d
  Breeder hen age – shell thickness, timing of oviposition