On Farm Hatching Egg Transport and Storage

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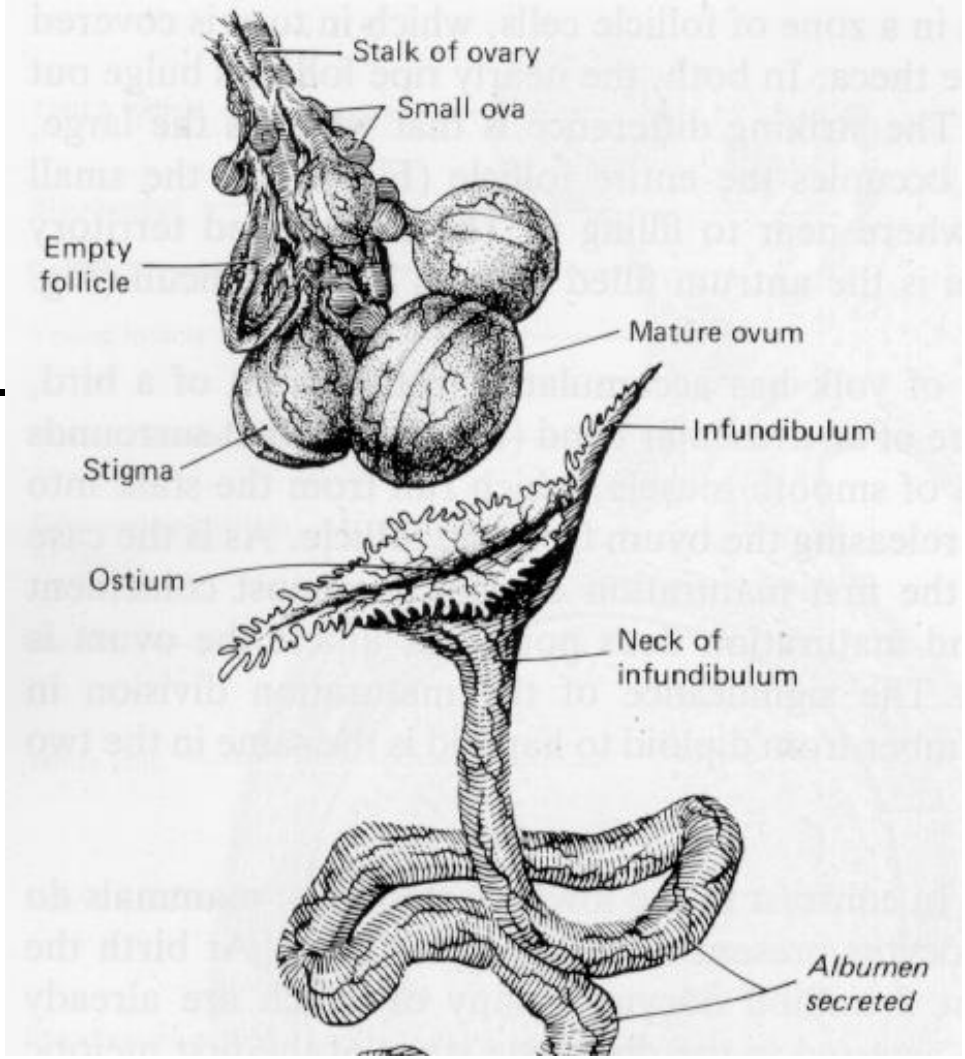
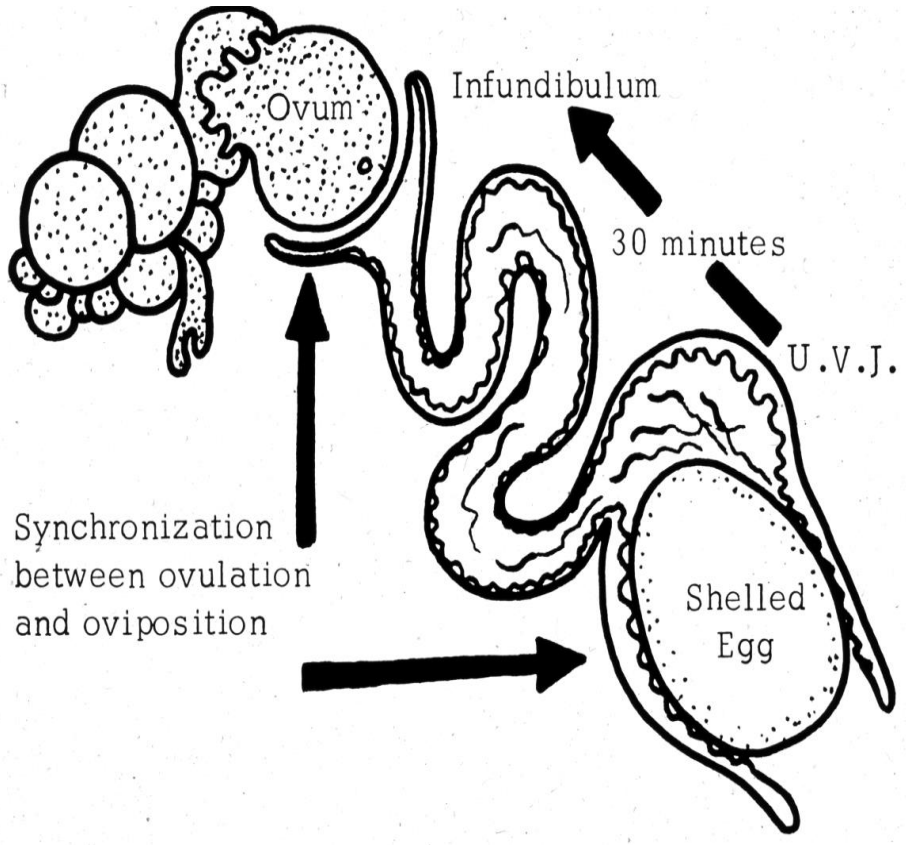
Fertilization

- Location - Infundibulum
- Funnel shaped – acts to engulf ovum



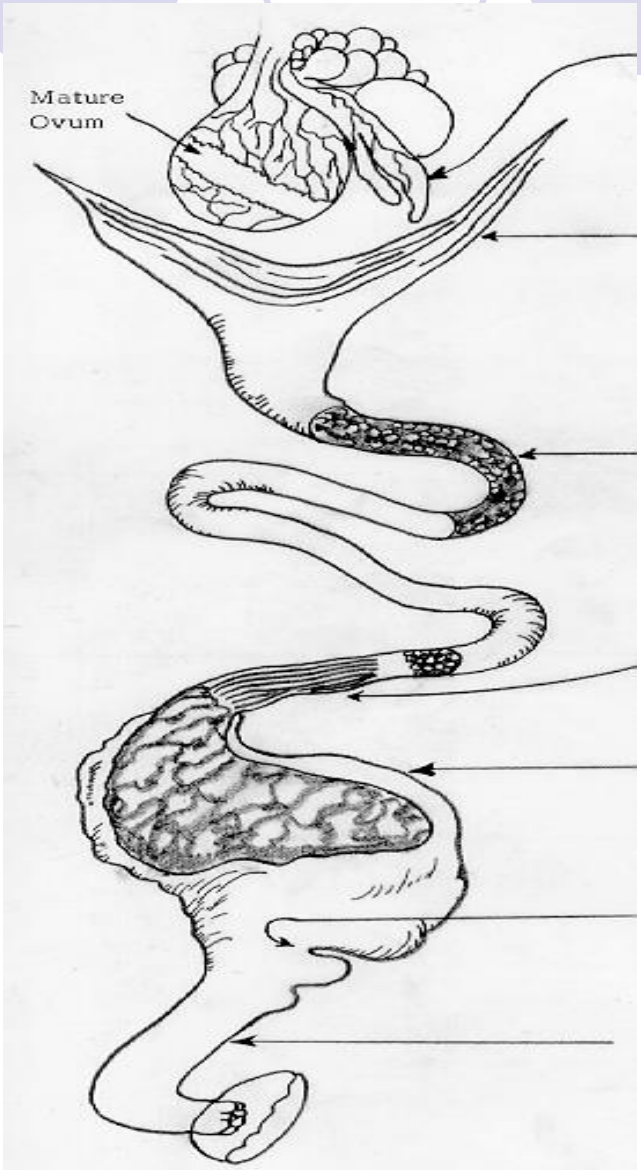
Female Reproductive System: Infundibulum

- Fertilization occurs < 5 minutes after ovulation
- Capture of ova is not necessarily a result of ovulation
- Ova present ~ 15 minutes (in chickens)



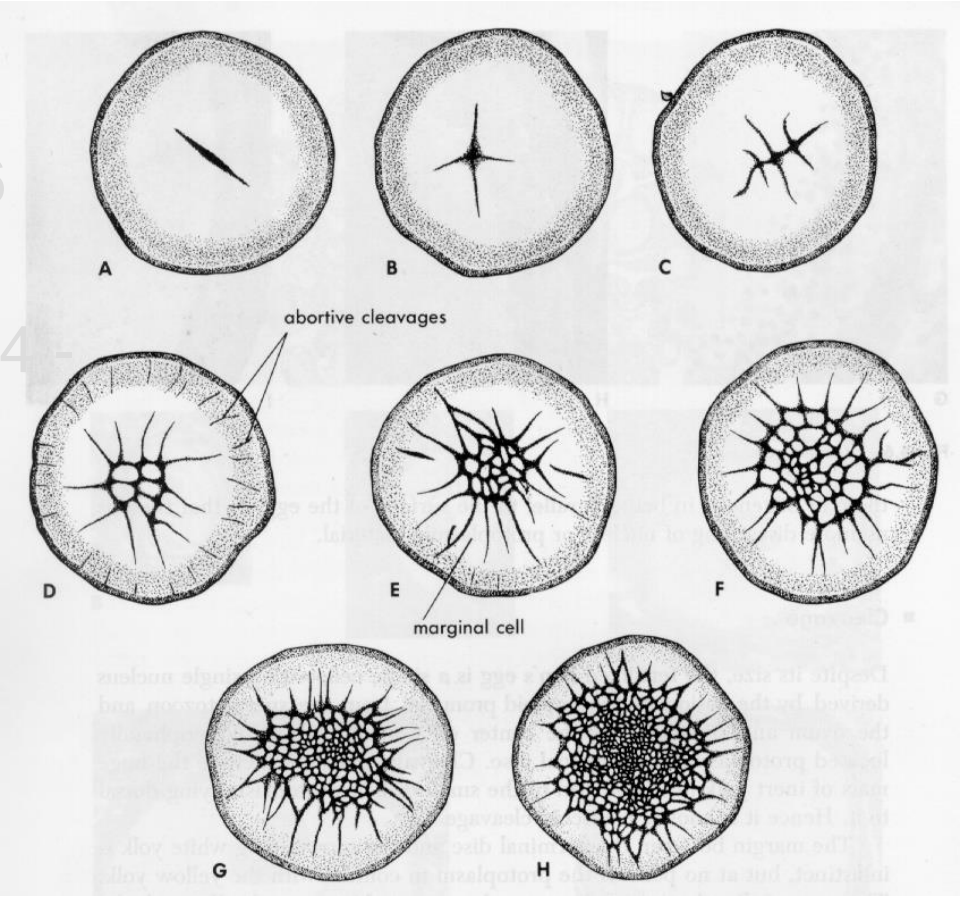
Fertilization

- Shell formation takes 24-26 hours to complete
- Hen's body temperature 104 - 106^{o} F



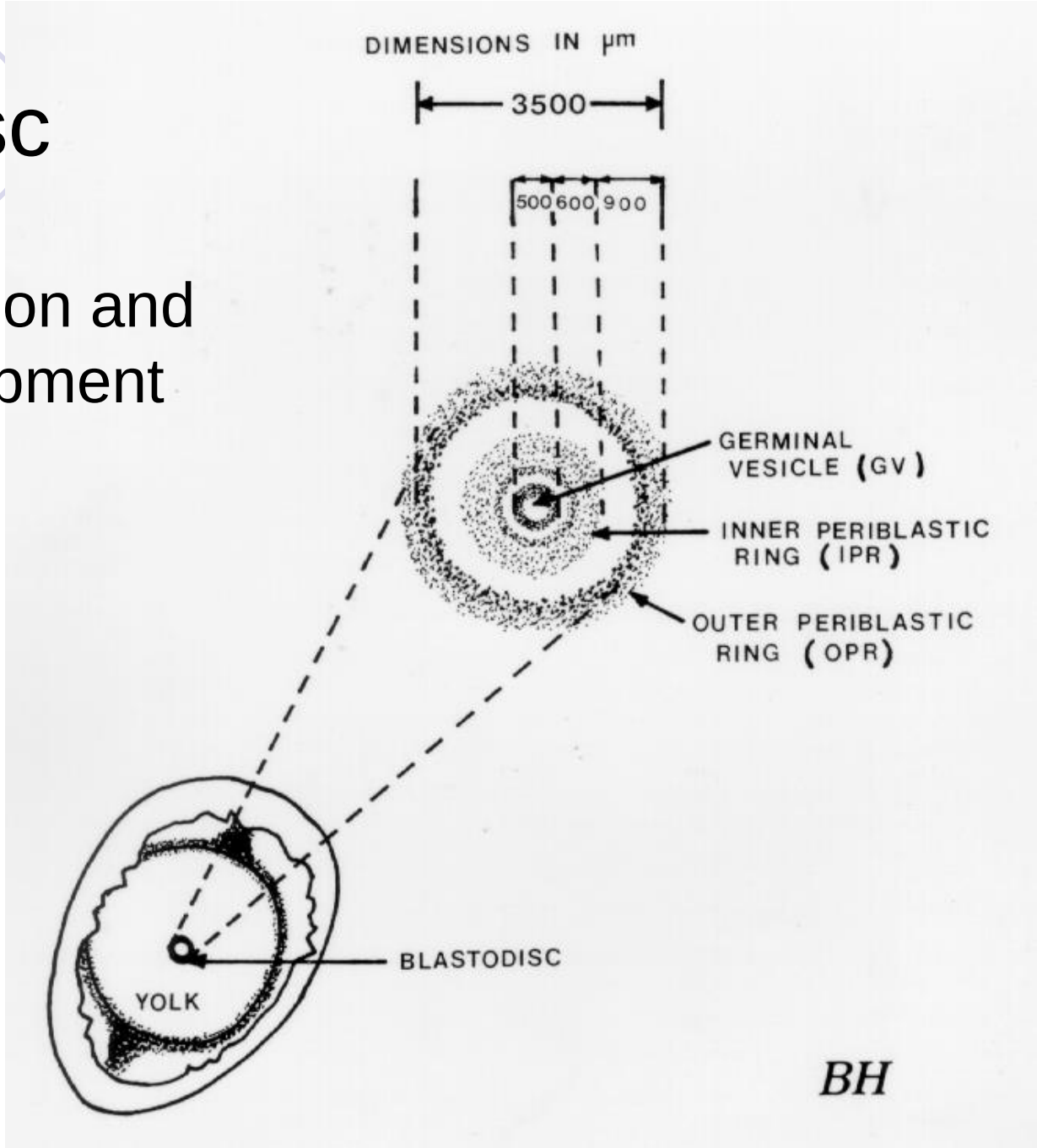
Fertilization & Embryo Development

- Fertilization occurs within 5 minutes after ovulation
- Shell formation takes 24-26 hours to complete
- Hen's body temperature 104 - 106° F
- Laid egg represents 1 days embryonic growth (20,000 - 40,000 cells)

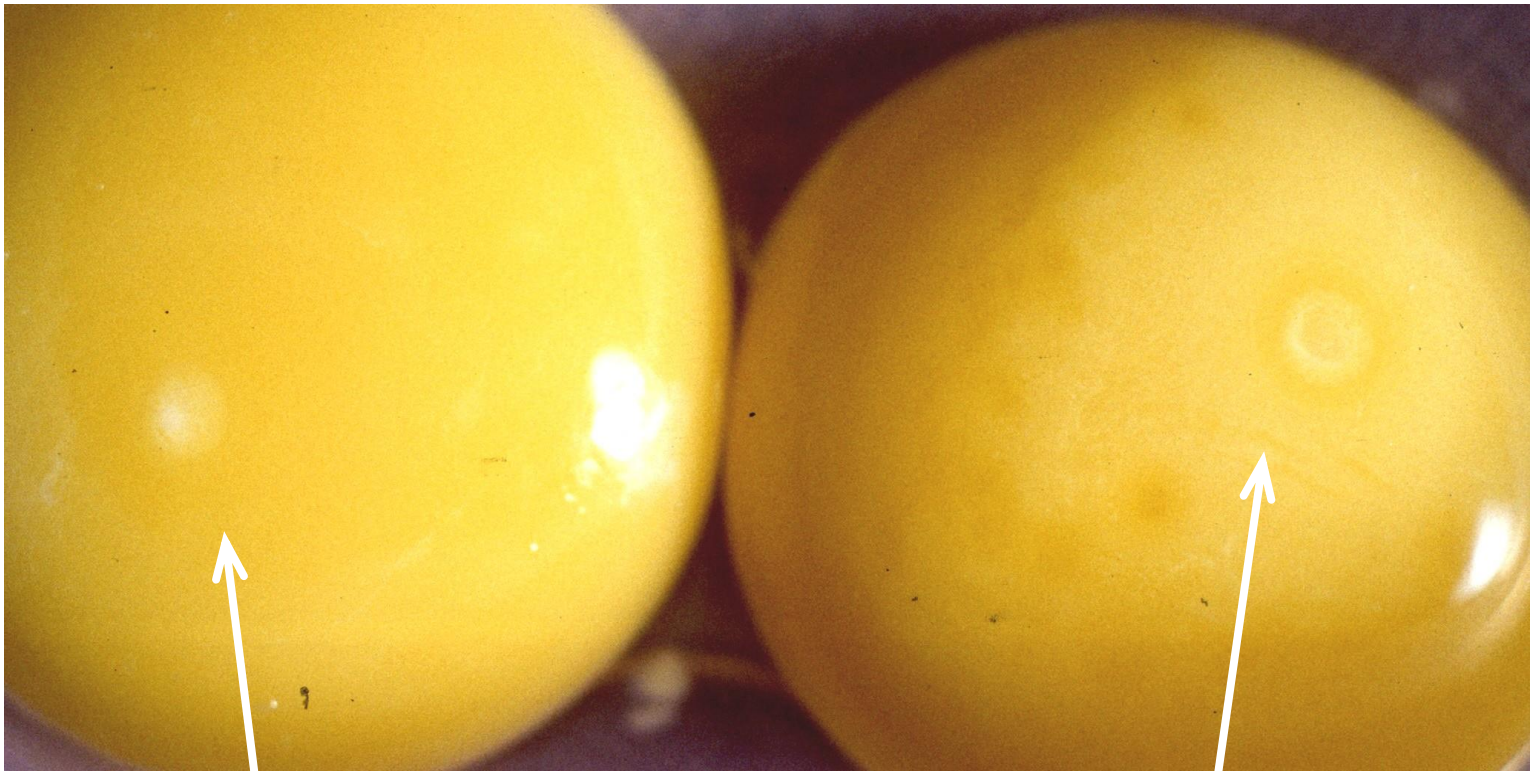


Germinal Disc

- Site of fertilization and embryo development

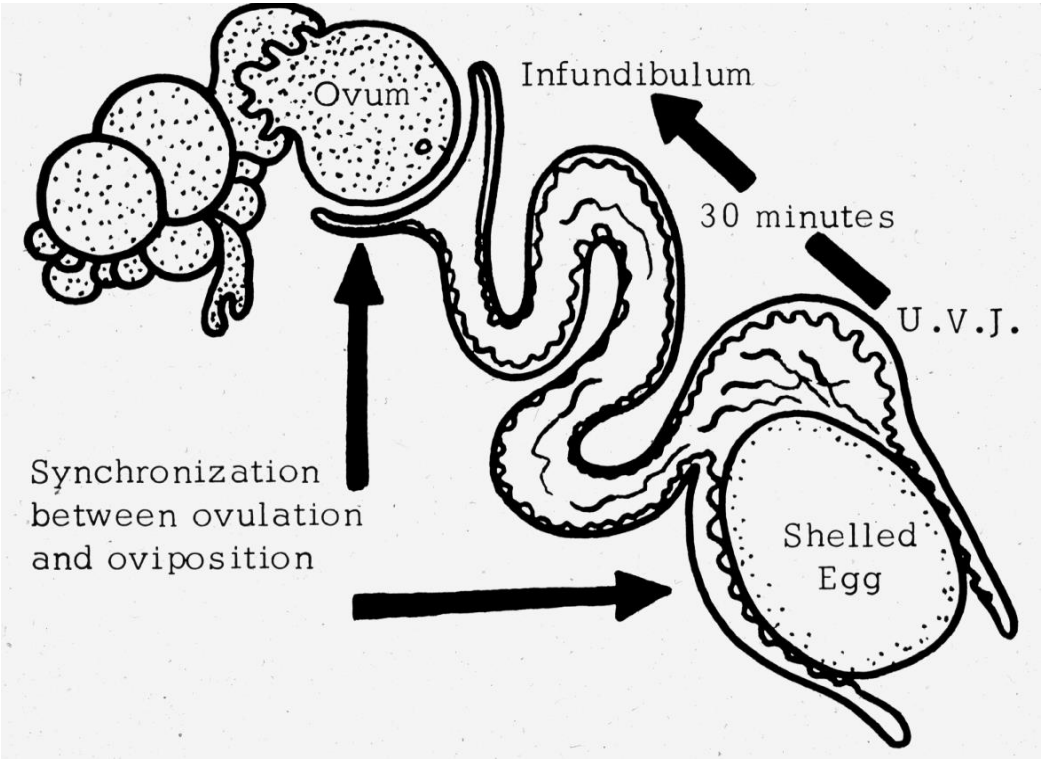


Fertile and Infertile Eggs



Sperm Cell Storage

- A biological necessity to produce fertile eggs in the avian system



Factors Which Influence Hatchability

- 1) Breeder flock: What's new?
  - Genetics of the bird
  - Management
  - Housing
  - Equipment

The Effects of Egg Pack on Hatch and Hatch of Fertile

Jon Moyle, Doug Yoho, Bob Harper, Ashley Swaffar, and Keith Bramwell, Department of Poultry Science, The University of Arkansas, Fayetteville

Types of eggs evaluated:

- Control
- Broken/cracked
- Cull/shell quality
- Dirty
- Sanded
- Wiped
- Upside Down

Broken Eggs

- Some are obviously broken
- Some small fractures are not noticeable
- Important to handle eggs with care

Cull Eggs

- Slab sided
- Long narrow
- Wrinkled
- Extra calcium deposits
- Misshaped
- Too small

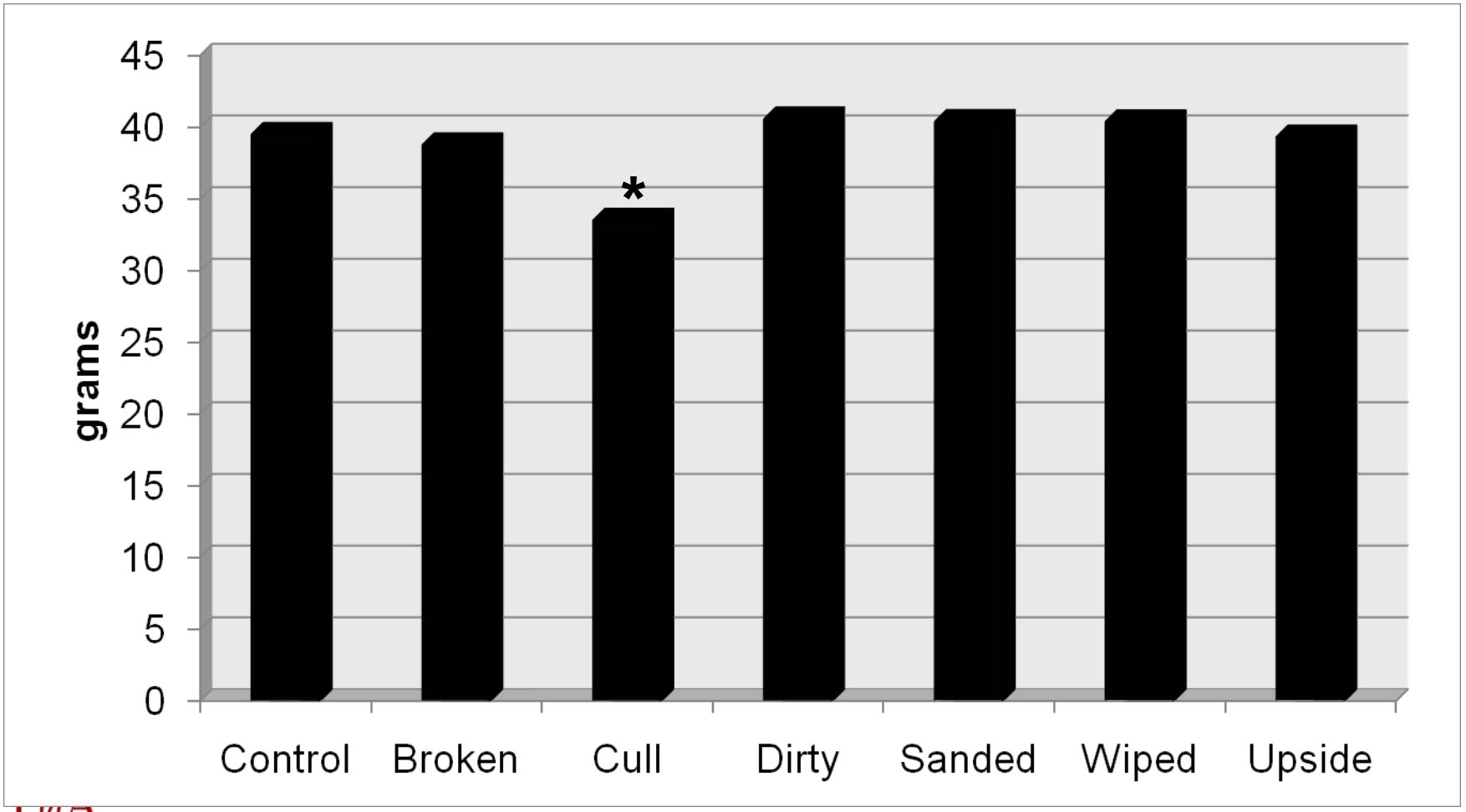
Dirty Eggs

- Fecal material
- Broken eggs
- Litter material
- Nesting material
- Blood

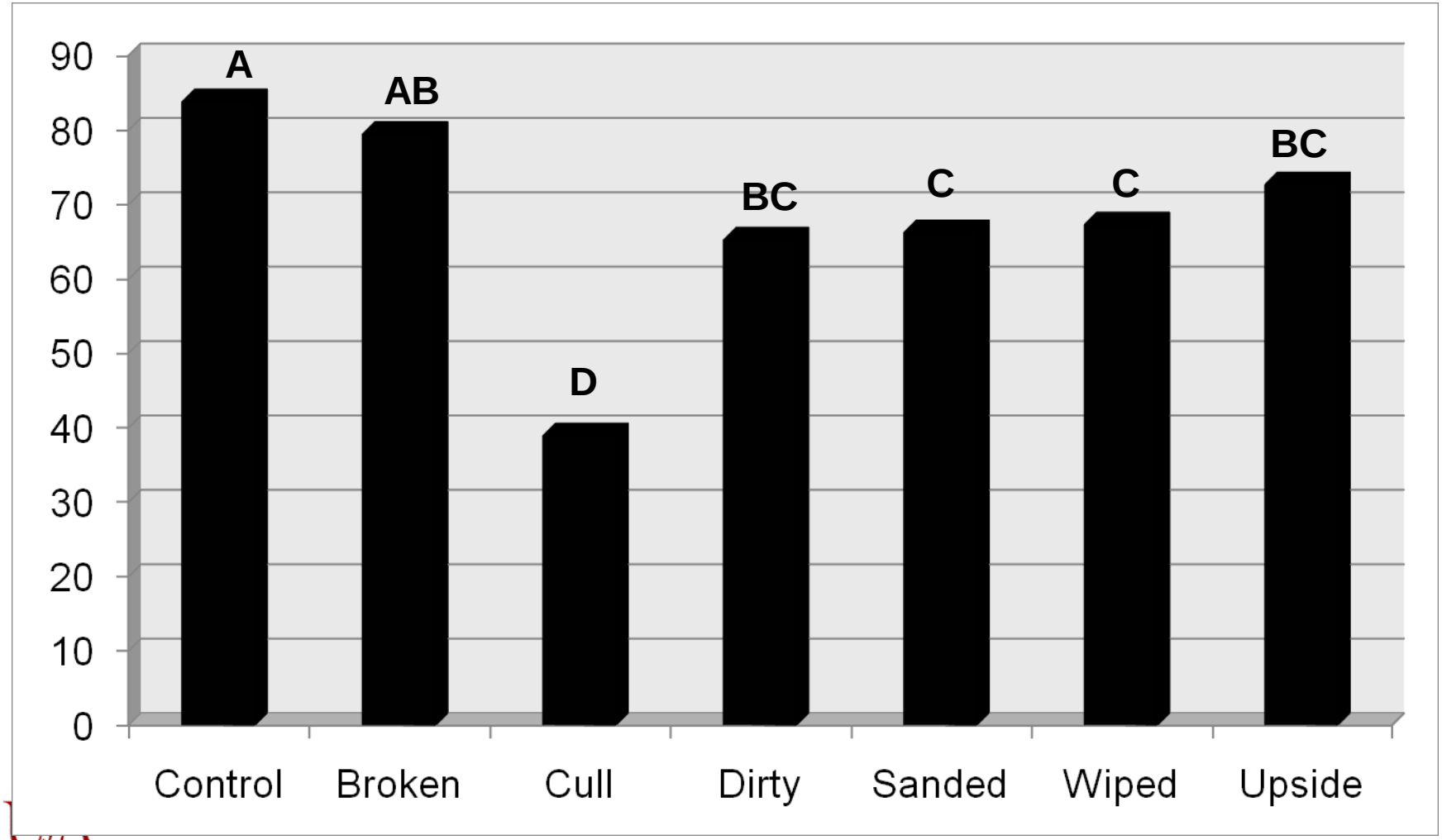
Dirty Eggs Sanded

Dirty Eggs Wiped

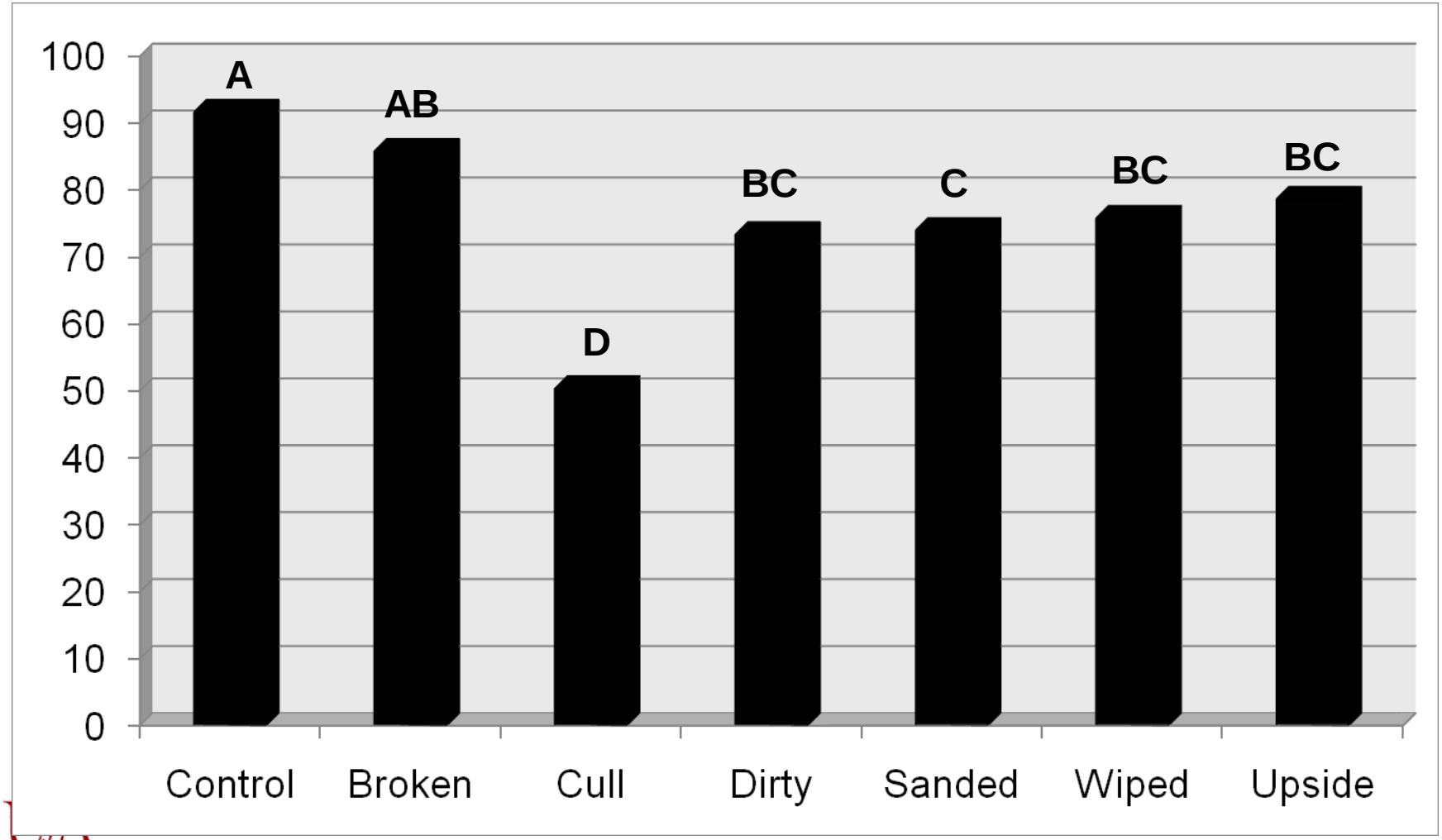
Average chick weight



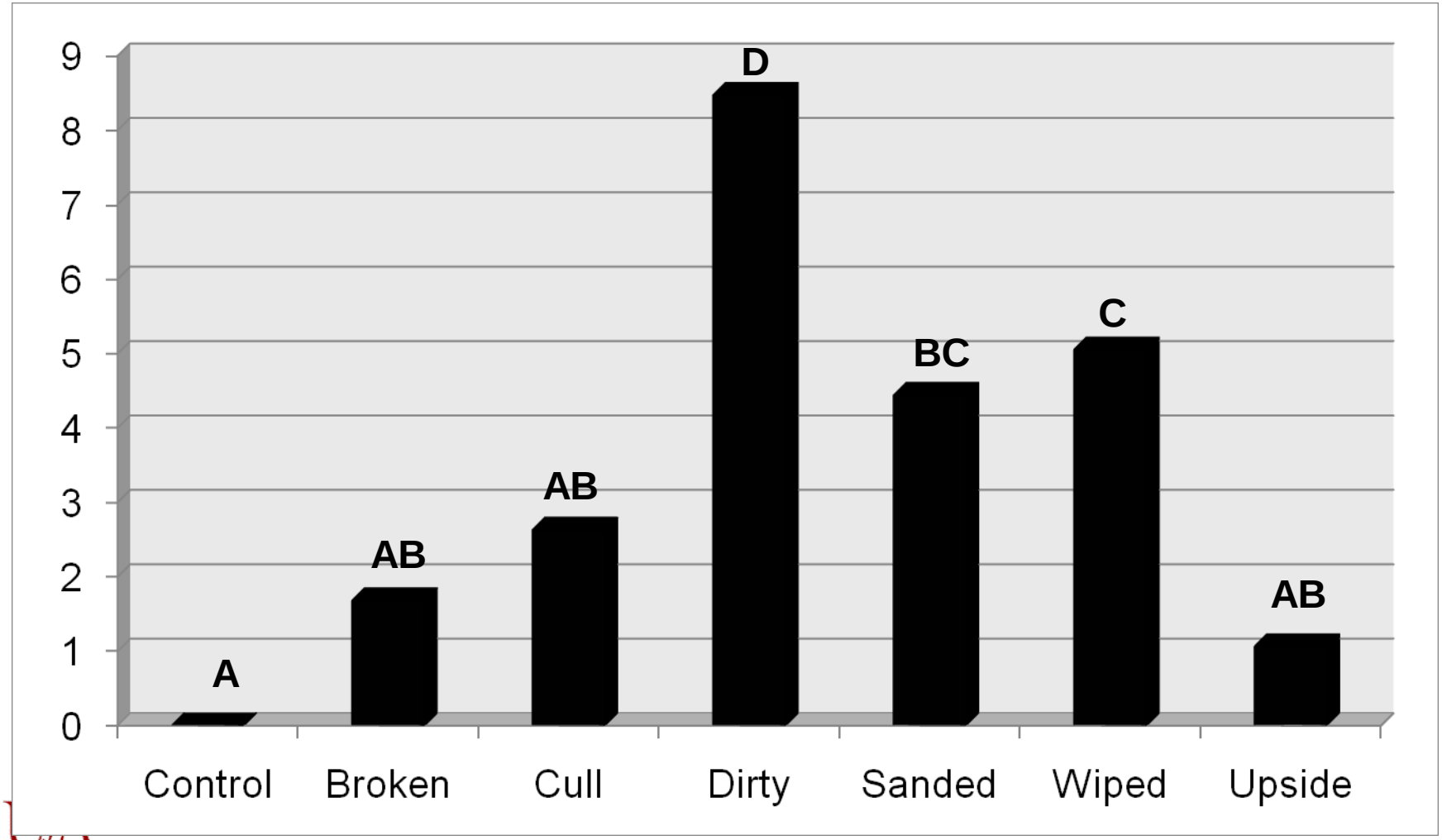
% Hatch


90
80
70
60
50
40
30
20
10
0
A
AB
D
BC
C
C
BC
Control
Broken
Cull
Dirty
Sanded
Wiped
Upside

% Hatch of Fertile



% Contamination



Egg Handling

- Needs more attention and has a huge impact on hatch of fertile.
- Egg handling starts at the farm and continues until the eggs are set in the incubator.

Lets Get Back To The Basics

- Egg gathering should be done at least 4X/day and 6X/day during peak production.
  - Why?
- Handle eggs carefully to avoid breakage.

Lets Get Back To The Basics

- Do not remove the farm racks from the cooler unless it is going to the egg truck.
- Keep cooler doors closed.
- Do not place farm racks with eggs in front of the cooler in the egg room.
- Avoid any hot or cold spots in cooler, either in general or by egg buggy placement.

Lets Get Back To The Basics

- Dirty eggs sent as hatching eggs need to be placed on bottom of farm racks.
- ‘Moderately’ clean hatching eggs.
  - Sand blocks – OK in moderation
  - Spray bottles, wash rags – generally a “no”

Effect of Egg Storage Temperature on Hatchability

Keith Bramwell, Savannah Henderson, Doug Yoho
The University of Arkansas,
Scott Martin, Cobb-Vantress, Inc.

Historical Perspective

- Egg storage conditions have been evaluated in the past and recommendations presented to receive optimum hatchability.
  - Altering *hatchery egg storage* conditions for each specific flock or age is not practical.

Historical Perspective

- On-farm egg storage provides opportunities to alter storage conditions for each specific flock either by age or other situations

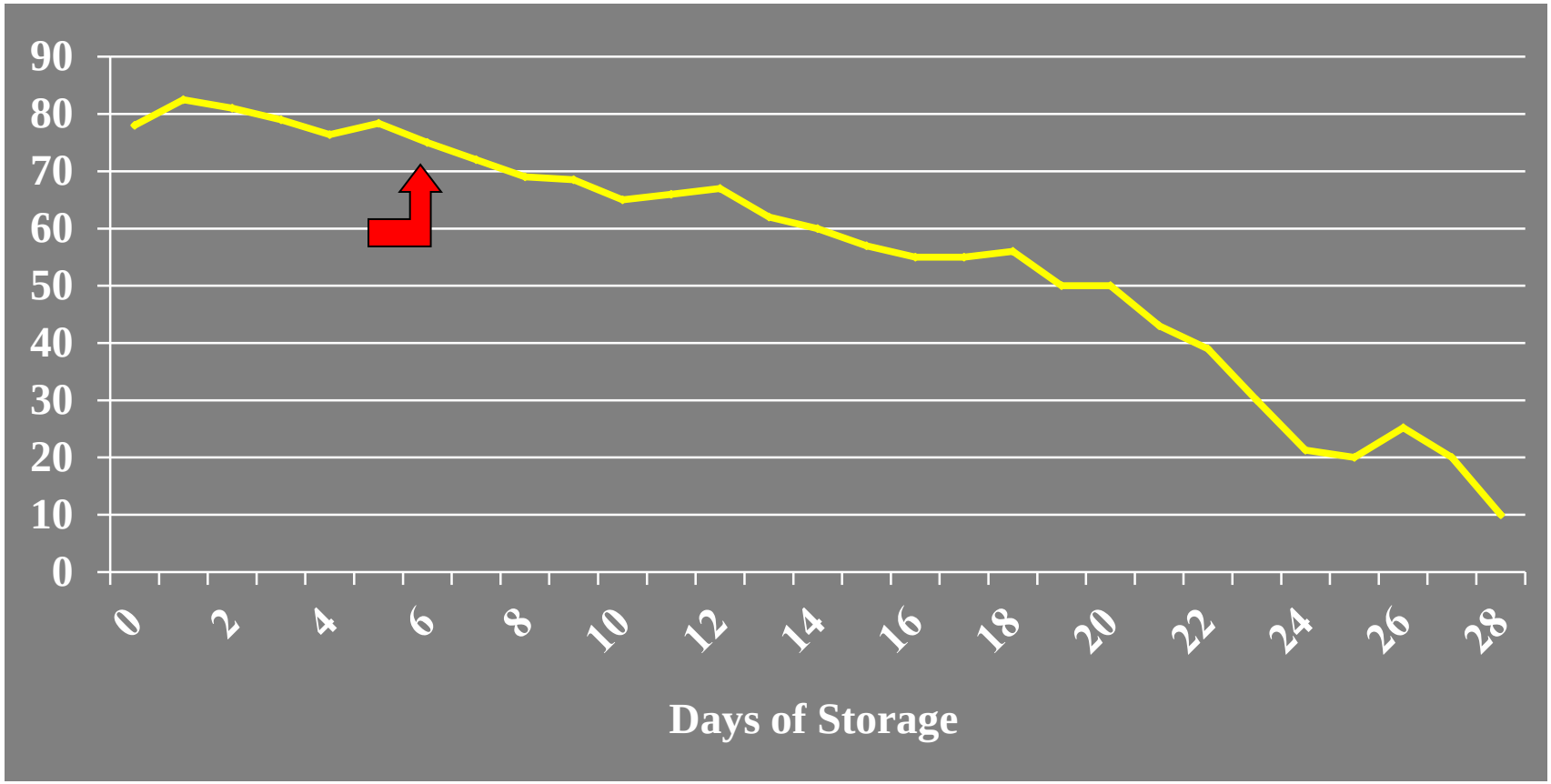
- What does egg storage and storage temperature do to embryo growth and hatchability?

Why Are Eggs Stored?

- Management perspective
  - To obtain sufficient egg numbers from each flock
  - Egg management, to fill machines/orders
- Physiological goals
  - Stop (or slow) embryo development

- Are our current methods and programs for on-farm hatching egg storage the most effective?

Effect Of Egg Storage On Hatchability



Purpose of Storing Hatching Eggs

- "Arrest" embryo development
- "Physiological Zero" - The temperature at which embryonic development stops, or is appreciably decreased
- In order for embryonic development to be virtually stopped, on-farm egg coolers are typically set between 63°F and 70°F

“Physiological Zero”

- What is this?
  - The temperature at which embryo development stops
- At what temperature does this occur?
  - From 66 º F to 86 º F
- First reports of 68 F ?
  - Edwards, 1902!

Embryo Development (Germinal Disc Size in mm)

Storage time	75 ° F	80 ° F	85 ° F	90 ° F	100 ° F
24 hr	4.96	5.44	6.01	7.41	12.29
48 hr	4.78	6.08	10.19	15.48	-
72 hr	4.87	6.54	16.68	28.23	-
96 hr	4.86	9.13	22.62	38.96	-

Experimental Design

- Hatching eggs were collected on day of lay and prior to placement in the existing on farm egg storage facility.

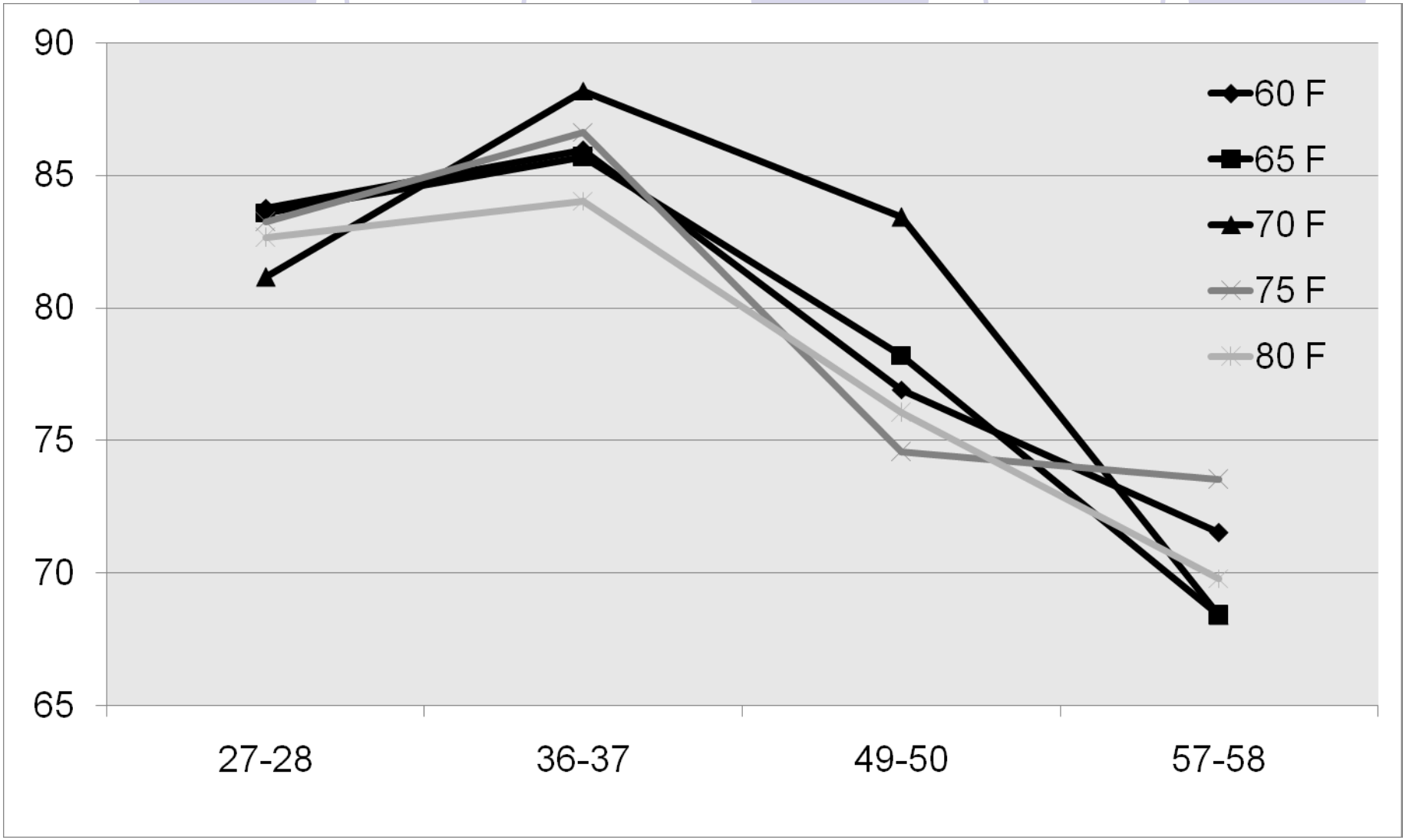
- Hatching eggs were randomly divided into five groups of 288 eggs per group.

Experimental Design

- Eggs were then placed into egg storage chambers with temperatures that were maintained at either 60, 65, 70, 75, or 80° F.

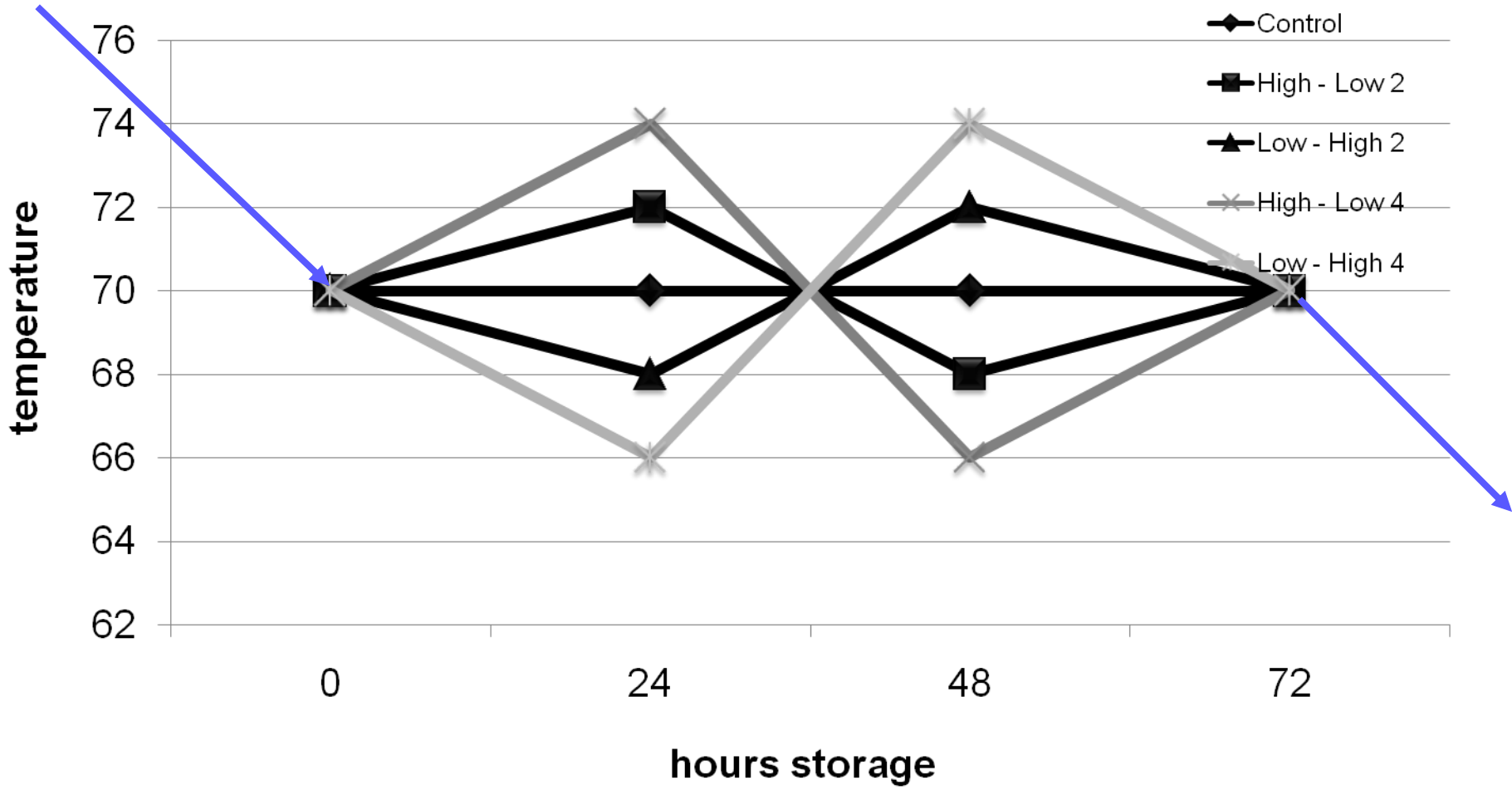
- Eggs were stored for three days.

Hatchability



- What does variations in on-farm hatching egg storage do to hatchability?

Fluctuating Egg Storage Temperature



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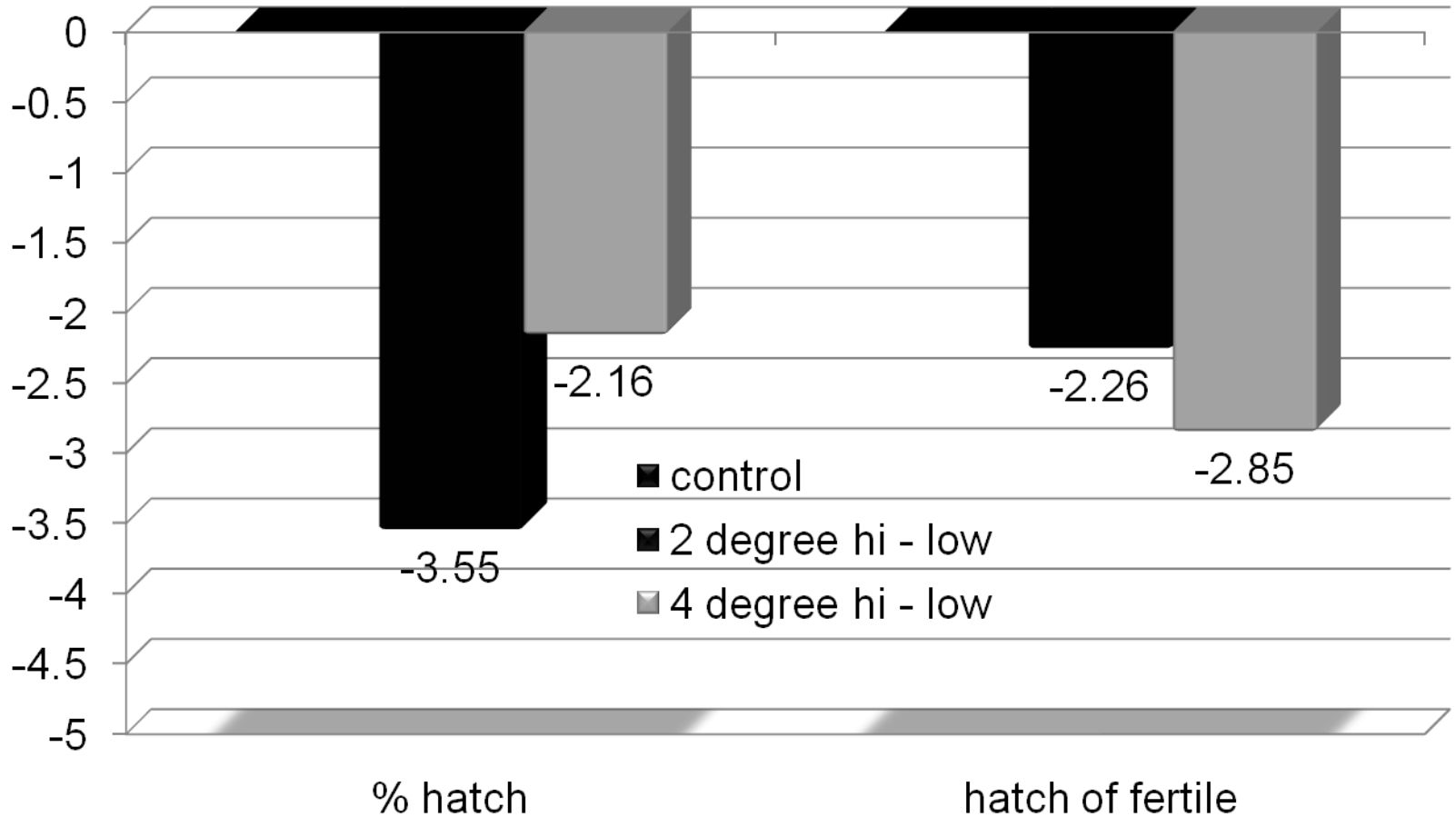
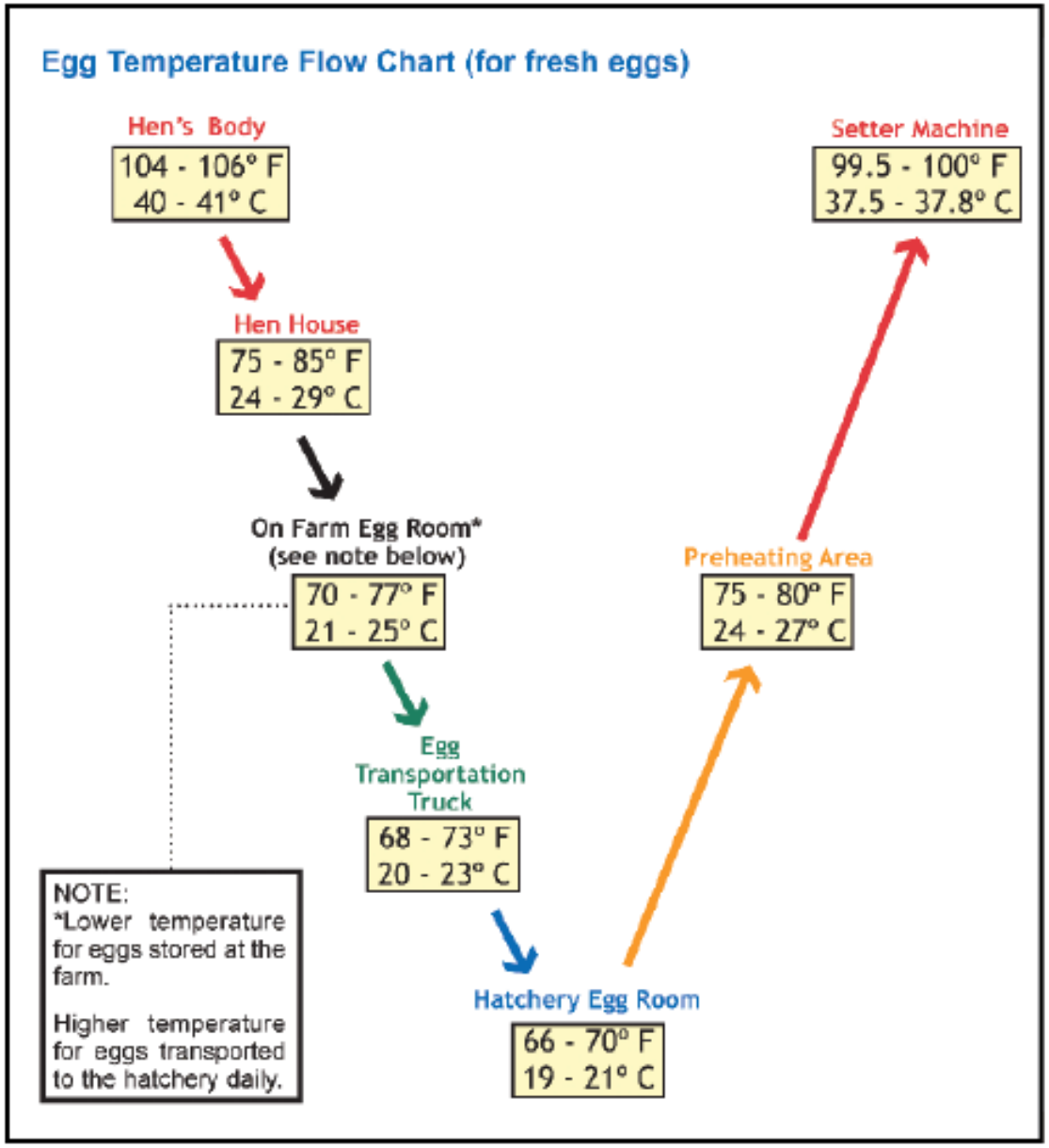
Hatch Loss Caused by Storage Temperature





While the industry recommends storage temperature of 20 C, actual on-farm storage temperature can range from 15.6 C to 23.9 C.

Data Loggers

- An important tool today is following egg room temperatures with data loggers.
- Data loggers can also follow temperature in the nest and belt.
- Many problems have been solved using data loggers to correct fluctuations or re-insulate farm coolers.

Summary

- Most hatchability problems are a result of poor fertility
- However, when egg production is attained, and the flock maintains high levels of fertility, how we care for hatching eggs can have a tremendous effect on the overall hatchability

Summary

- Current industry recommendations vary from 63° to 70° F for on farm egg storage.
- However, data from this research indicates that hatchability is improved in flocks at prime + age (35-50 wks) when stored at 70° F.
- In addition, older flocks (> 55 wks) hatched better when stored at 75 º F.

Summary

- This data suggests that maintaining a constant internal egg temperature is critical to achieving optimum hatchability.
- When on farm egg storage temperatures are allowed to fluctuate, hatchability can be reduced by up to 4%.

Recommendations

- 1) young flocks (< 30 wks), 66 – 68 F on farm egg storage temperature
  - Young hens produce an egg with a physiologically less viable embryo
- 2) early and mid age flocks (30 – 50 wks), 70 – 72 F on farm egg storage
  - Why stress the developing embryo more than is necessary?

Recommendations

- 3) older flocks (> 50 wks), 73 - 75 F on farm egg storage
  - Embryos in eggs from older flocks are less viable and more susceptible to stress
- 4) maintain a constant egg storage temperature, reduce fluctuations
  - Egg handling (egg traffic) and quality of the egg room

Incubation and Hatchery Management

Keith Bramwell, PhD
Department of Poultry Science
The University of Arkansas

Introduction

- Advances in hatchery and incubation technology and the equipment available continues to improve and provide opportunities previously unavailable

Introduction

- However, the premise stays the same, create an environment similar to what the broody hen provided to her nest of eggs and her young

Hatchability

- “The measure of success” of any hatchery or breeder/hatchery program is the total number of first quality chicks produced
- The number expressed as a percentage of all eggs set for incubation is normally termed hatchability

Percent Hatchability

$$\frac{\text{1,000 eggs set}}{\text{873 chicks hatched}} = 87.3\% \text{ hatch}$$

Hatchability

Controlling Factors	
Farm	**Hatchery**
Breeder Nutrition	Sanitation
Disease	Egg Storage
Infertility	Egg Damage
Egg Damage	Incubation – management of setters and hatchers
Egg Sanitation	Chick Handling
Egg Storage	

Hatch of Fertile

- Hatcheries have no influence over fertility
- “Hatch of Fertile” is the best value hatcheries can utilize to measure success
- This takes into account the fertility level of the breeder flock source

Percent Hatch of Fertile

$$\frac{\text{873 chicks hatched}}{\text{1,000 eggs set}} = 87.3\% \text{ hatch}$$

$$\frac{\text{87.3 \% hatch}}{\text{95.0 \% fertility}} = 91.9\% \text{ hatch of fertile}$$

Hatch of Fertile

87.3% hatch / 95% fertile * 100 = **91.9% Hatch of Fertile**

Hatchery	% Hatch	% Fertile	% Hatch of Fertile
A	86	97	88.66
B	82	91	90.11
C	84	96	87.50

Hatch of Fertile

- Hatchability is an indication of the breeder-hatchery program
- Hatch of Fertile is an indication of the hatchery management

Hatch of Fertile

- Benefits of hatch of fertile

- 1) Separates breeder flock and hatchery problems quickly
- 2) Actual problems can be addressed
- 3) Expedites troubleshooting

Embryodiagnosis

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Embryonic Mortality Pattern

- 1-7 days (2 - 4 days)
  - ~ 3.0 %
  - Blood & circulation system developing
- Potential causes
  - Poor egg handling (gathering & storage)
  - Aged flocks (infrequent mating)
  - Incubator problems

Embryonic Mortality Pattern

- 8 -14 days
  - ~ 0.5%
- Potential causes
  - Incubator problems
  - Breeder nutrition
    - Riboflavin
    - Vitamin B12
    - Manganese
    - Pantothenic acid

Embryonic Mortality Pattern

- 15-21 days (19-21 days)
  - ~ 2.5 %
  - Switch to pulmonary respiration
- Potential causes
  - Increase moisture loss (pull time, low humidity, poor shell quality, etc)
  - Aged flocks
  - Contamination
  - Egg orientation

Methodology

- Important for managers to have direct knowledge of breakout results
- Managers should monitor candling and breakout procedure routinely and correlate with people doing breakout
- Best if managers can assist on breakouts, especially when problems exist or decisions are to be made based on breakout

Fertility

- We must have fertility to get hatch
- Timely break-out data gives an early assessment of flock fertility
- 10 day candling break-out provides more accurate fertility than residue break-out
  - Residue breakout should not be used to determine fertility
- Predict hatch based on hatch of fertiles once fertility is known

Fertile Vs. Infertile

- Do not classify abnormal conditions as fertile
  - Blood spots (not blood ring remnants)
  - Meat spots
  - Mottled yolks
  - Contamination (esp. Yeast)
  - Chalaza

Infertile

Embryonic Development

- No development

Troubleshooting Guide

- Immature males – need stimulation 2 weeks before hens
- Too few males, infrequent mating
- Too many males, infrequent mating
- Extreme weather conditions
- Old breeders
- Breeder flock disease
- Excess body weight
  - males and females
- Feet and leg problems
  - Males, heavy breeds

Infertile

Embryonic Development

- No development

Troubleshooting Guide

- Males and hens with abnormal sperm or egg
  - Both occur in young or old
- Nutritional deficiencies, excesses
  - Severe feed restriction
- Certain drugs, pesticides, chemicals, toxins, mycotoxins
- Parasites, such as mites
- Inadequate floor space
- Inadequate lighting (intensity or length)
- DECREASED MATING FREQUENCY

Day 1

Embryonic Development

- Appearance of tissue development

Troubleshooting Guide

- Low fertility
- Pre-incubation, poor egg storage
- Improper fumigation
- Improper turning
- Improper temperature
- Improper humidity
- Improper ventilation
- Inverted eggs
- Rough egg handling
- Improper egg holding time
- Rough setting of eggs
- Contaminated eggs
- Nutritional- drugs-toxins

Day 2

Embryonic Development

- Tissue development very visible
- Appearance of blood vessels

Troubleshooting Guide

- Low fertility
- Pre-incubation, poor egg storage
- Improper fumigation
- Improper turning
- Improper temperature
- Improper humidity
- Improper ventilation
- Inverted eggs
- Rough egg handling
- Improper egg holding time
- Rough setting of eggs
- Contaminated eggs
- Nutritional- drugs-toxins

Day 3

Embryonic Development

- Heart beats
- Blood vessels very visible

Troubleshooting Guide

- Low fertility
- Pre-incubation, poor egg storage
- Improper fumigation
- Improper turning
- Improper temperature
- Improper humidity
- Improper ventilation
- Inverted eggs
- Rough egg handling
- Improper egg holding time
- Rough setting of eggs
- Contaminated eggs
- Nutritional- drugs-toxins

Day 4

Embryonic Development

- Eye pigmented

Troubleshooting Guide

- Improper turning
- Improper temperature
- Improper humidity
- Improper ventilation
- Inverted eggs
- Rough setting of eggs
- Contaminated eggs
- Nutritional
  - Vitamin E, riboflavin, biotin, pantothenic acid, linoleic acid
- Drugs-toxins

Day 5

Embryonic Development

- Appearance of elbows and knees

Troubleshooting Guide

- Improper turning
- Improper temperature
- Improper humidity
- Improper ventilation
- Inverted eggs
- Rough setting of eggs
- Contaminated eggs
- Nutritional
  - Vitamin E, riboflavin, biotin, pantothenic acid, linoleic acid
- Drugs-toxins

Day 6

Embryonic Development

- Appearance of beak
- Voluntary movement begins

Troubleshooting Guide

- Improper turning
- Improper temperature
- Improper humidity
- Improper ventilation
- Inverted eggs
- Rough setting of eggs
- Contaminated eggs
- Nutritional
  - Vitamin E, riboflavin, biotin, pantothenic acid, linoleic acid
- Drugs-toxins

Day 7

Embryonic Development

- Comb growth begins
- Egg tooth begins to appear

Troubleshooting Guide

- Improper turning
- Improper temperature
- Improper humidity
- Improper ventilation
- Inverted eggs
- Rough setting of eggs
- Contaminated eggs
- Nutritional
  - Vitamin E, riboflavin, biotin, pantothenic acid, linoleic acid
- Drugs-toxins

Day 8

Embryonic Development

- Feather tracts seen
- Upper and lower beak equal in length

Troubleshooting Guide

- Improper turning
- Improper temperature
- Improper humidity
- Improper ventilation
- Inverted eggs
- Insufficient egg holding time
- Rough setting of eggs
- Contaminated
- Nutritional
  - Riboflavin, vitamin B12, biotin, niacin, pyridoxine, pantothenic acid, phosphorous, boron, linoleic acid

Day 9

Embryonic Development

- Embryo starts to look bird like
- Mouth opening appears

Troubleshooting Guide

- Improper turning
- Improper temperature
- Improper humidity
- Improper ventilation
- Inverted eggs
- Insufficient egg holding time
- Rough setting of eggs
- Contaminated
- Nutritional
  - Riboflavin, vitamin B12, biotin, niacin, pyridoxine, pantothenic acid, phosphorous, boron, linoleic acid

Day 10

Embryonic Development

- Egg tooth prominent
- Toe nails

Troubleshooting Guide

- Improper turning
- Improper temperature
- Improper humidity
- Improper ventilation
- Inverted eggs
- Insufficient egg holding time
- Rough setting of eggs
- Contaminated
- Nutritional
  - Riboflavin, vitamin B12, biotin, niacin, pyridoxine, pantothenic acid, phosphorous, boron, linoleic acid

Day 11

Embryonic Development

- Comb serrated
- Tail feathers apparent

Troubleshooting Guide

- Improper turning
- Improper temperature
- Improper humidity
- Improper ventilation
- Inverted eggs
- Insufficient egg holding time
- Rough setting of eggs
- Contaminated
- Nutritional
  - Riboflavin, vitamin B12, biotin, niacin, pyridoxine, pantothenic acid, phosphorous, boron, linoleic acid

Day 12

Embryonic Development

- Toes fully formed
- First few visible feathers

Troubleshooting Guide

- Improper turning
- Improper temperature
- Improper humidity
- Improper ventilation
- Inverted eggs
- Insufficient egg holding time
- Rough setting of eggs
- Contaminated
- Nutritional
  - Riboflavin, vitamin B12, biotin, niacin, pyridoxine, pantothenic acid, phosphorous, boron, linoleic acid

Day 13

Embryonic Development

- Appearance of scales
- Body covered lightly with feathers

Troubleshooting Guide

- Improper turning
- Improper temperature
- Improper humidity
- Improper ventilation
- Inverted eggs
- Insufficient egg holding time
- Rough setting of eggs
- Contaminated
- Nutritional
  - Riboflavin, vitamin B12, biotin, niacin, pyridoxine, pantothenic acid, phosphorous, boron, linoleic acid

Day 14

Embryonic Development

- Embryo turns head towards large end of egg

Troubleshooting Guide

- Improper turning
- Improper temperature
- Improper humidity
- Improper ventilation
- Inverted eggs
- Insufficient egg holding time
- Rough setting of eggs
- Contaminated
- Nutritional
  - Riboflavin, vitamin B12, biotin, niacin, pyridoxine, pantothenic acid, phosphorous, boron, linoleic acid

Day 15

Embryonic Development

- Gut is drawn into abdominal cavity

Troubleshooting Guide

- Improper turning
- Improper temperature
- Improper humidity
- Improper ventilation
- Inverted eggs
- Contaminated
- Nutritional
  - Riboflavin, vitamin B12, biotin, niacin, pyridoxine, pantothenic acid, phosphorous, boron, linoleic acid

Day 16

Embryonic Development

- Feathers cover complete body
- Albumen nearly gone

Troubleshooting Guide

- Improper turning
- Improper temperature
- Improper humidity
- Improper ventilation
- Inverted eggs
- Contaminated
- Nutritional
  - Riboflavin, vitamin B12, biotin, niacin, pyridoxine, pantothenic acid, phosphorous, boron, linoleic acid

Day 17

Embryonic Development

- Amniotic fluid decreases
- Head is between legs

Troubleshooting Guide

- Improper turning
- Improper temperature
- Improper humidity
- Improper ventilation
- Inverted eggs
- Contaminated
- Nutritional
  - Riboflavin, vitamin B12, biotin, niacin, pyridoxine, pantothenic acid, phosphorous, boron, linoleic acid

Day 18

Embryonic Development

- Growth of embryo nearly complete
- Yolk sac is still on outside of embryo
- Head is under the right wing

Troubleshooting Guide

- Hatcher opened too much during hatch cycle
- Rough transfer
  - Transfer cracks, delays
- Wet trays and hatchers
- Inconsistent transfer
- Improper turning
- Improper temperature
- Improper humidity
- Improper ventilation
- Inverted eggs
- Contaminated – molds, etc
- Nutritional

Day 19

Embryonic Development

- Yolk sac draws into body cavity
- Amniotic fluid gone
- Embryo occupies most of space within egg(not in the air cell)

Troubleshooting Guide

- Hatcher opened too much during hatch cycle
- Rough transfer
  - Transfer cracks
- Wet trays and hatchers
- Inconsistent transfer
- Improper turning
- Improper temperature
- Improper humidity
- Improper ventilation
- Inverted eggs
- Contaminated, molds etc
- Nutritional

Day 20

Embryonic Development

- Yolk sac drawn completely into body
- Embryo becomes a chick(breathing in air cell)
- Internal & external pip

Troubleshooting Guide

- Hatcher opened too much during hatch cycle
- Rough transfer
  - Transfer cracks
- Wet trays and hatchers
- Inconsistent transfer
- Improper turning
- Improper temperature
- Improper humidity
- Improper ventilation
- Inverted eggs
- Contaminated, molds etc
- Nutritional

Day 20

Embryonic Development

- Yolk sac drawn completely into body
- Embryo becomes a chick(breathing in air cell)
- Internal & external pip

Troubleshooting Guide

- Nutritional deficiencies
  - Vitamin D, vitamin A, folic acid, pantothenic acid, riboflavin, vitamin E, selenium, vitamin K, biotin, thiamin, vitamin B12, calcium, phosphorous, manganese, linoleic acid
- Breeder disease
- Poor shell quality

How Did The Best Hatching Operations Get There?

- Fertility
- Good hatchery management

Strategy

- Learn to use egg break-out data to develop action plans for hatch improvement and monitor results of the action plan.

Action Plan

- Accurate egg break-out
  - Hatchery manager & supervisor involvement
- Standard summary
- Analysis of data
- Action plan of correction
- Use information as a management tool

Residue Breakout Mortality

Flock Examination & Record Keeping

- Breakout analysis of a sample of unhatched eggs and record incidences of:
  - Infertiles
  - Dead embryos in one of the 3 stages
  - Pips
  - Cull chicks and cull eggs
  - Farm & transfer cracks
  - Contamination
  - Misplaced eggs (small end up)

Flock Examination & Record Keeping

- Determine percent weight loss from samples of eggs
  - Weigh eggs prior to incubation
  - Weigh eggs at transfer
  - Calculate weight loss (moisture)
    - Ideal range 0.6 - 0.65 % per day
    - Acceptable 0.55 - 0.7 % per day

Trouble Shooting Hatchery Problems

- Can the problem be identified with:
  - Specific flocks or flock ages?
  - Specific setters, hatchers or other equipment?
  - Any unusual weather patterns?
  - Seasonal changes?
  - Recent changes in management practices or personnel?

Trouble Shooting Hatchery Problems

- Does the problem persist?
- Do you know what is *normal,* or what should be expected?
- How has this same bird or combination performed in the past?

Pipped

- Signs
  - Dead in shell
  - Full-term embryo
- Causes
  - Low humidity or temperature for long periods
  - Hatcher humidity low
  - High temperatures during hatching
  - Nutritional deficiencies
  - Breeder disease
  - Poor ventilation
  - Inadequate turning (day 1-12)
  - Injury during transfer
  - Prolonged egg storage

Not Pipped

- Signs
  - Dead in shell
  - Full term embryo
  - Large yolk sac
  - Yolk sac may not be fully engulfed by abdominal wall
  - May have residual albumen
- Causes
  - Inadequate turning
  - Humidity high
  - Setter temperature low
  - Eggs chilled (transfer)
  - Nutritional deficiencies
  - Genetics
  - Embryo accidental development
  - Breeder disease
  - Poor ventilation
  - Prolonged egg storage

Partially Pipped

- Signs
  - Embryo alive
  - Embryo dead
- Causes
  - Same as for pipped, full-term embryos
  - Excessive fumigation during hatching
  - Egg set small end up

Malpositioned Chicks

- Signs
  - Normal position after 19 days
  - Embryo long axis same as egg long axis
  - Head in large end of egg
  - Head to the right and under right wing
  - Beak towards air cell
  - Feet towards head
- Causes
  - Eggs set small end up
  - Improper egg turning
  - Setter temperature too high or too low
  - Humidity too high
  - Old breeders
  - Round shaped eggs or very large eggs
  - Nutritional deficiencies
    - Vit A and vit B_{12}
  - Poor egg handling or storage
  - Retarded development

Chicks Hatching Early

- Signs
  - Excessively noisy chicks
  - Thin chicks
  - Dry skin around legs and feet
  - Increased 7 day field mortality
- Causes
  - Small eggs
  - Breed differences
  - Setter temperature too high
  - Setter humidity too low

Chicks Hatching Late

- Signs
  - Called ‘green chicks’
  - Swollen abdomen
- Causes
  - Large eggs
  - Old breeders
  - Eggs stored too long
  - Setter temperature too low
  - Weak embryos
  - Inbreeding (genetics)
  - Setter humidity too high

Slow Hatch

- Signs
  - Protracted or ‘drawn-out’ hatch
  - Mixture of early and late hatched chicks
  - Chicks begin hatching early but slow to finish

- Causes
  - Mixture of eggs stored too long and too short
  - Mixture of eggs from young and old breeders
  - Mix of large and small eggs
  - Improper egg handling
  - Hot or cold spots in setters or hatchers
  - High or low temperatures in setters or hatchers
  - Poor ventilation in machines and rooms & hallways

Poor Chick Quality

- Signs
  - Hatching trays not hatching uniformly throughout machine
- Causes
  - Mix of large and small eggs
  - Mix of eggs from young and old breeders
  - Mix of eggs from different strains (breeds)
  - Variation in egg storage
  - Setter or hatcher ventilation not uniform
  - Disease or stress in some breeder flocks
  - Variation in on farm egg storage procedures

Cross Beak & Missing Eye

- Temperature too high
- Egg turning problems

Brain Hernia (Exposed Brain)

- Temperature too high
- Egg turning problems
- High CO_2 level

- Equipment malfunction

Malformations

- Signs
  - Posterior duplication
  - Any multiple truncated development
- Causes
  - Poor egg storage and handling
  - Genetics
  - Nutritional deficiencies
    - Examples: biotin, riboflavin, zinc, manganese
  - Inadequate turning
  - Improper egg orientation (small end up)
  - Setter temperature too high or too low
  - Breeder disease
  - Poor ventilation or poor conductivity of eggs

Open or Unhealed Navel

- Signs
  - Open and unhealed navels
  - Dry, rough down feathers
- Causes
  - Setter temperature too high or variation in temperature
  - Hatcher temperature low
  - Hatcher humidity too high, or not lowered at hatch completion
  - Poor breeder nutrition

Stringy Navel

- Temperature too high
- Temperature too low

Unhealed Navel, Infection

- Signs
  - Wet, odorous chicks
  - Large, mushy
  - Soft bodied, lethargic
- Causes
  - Omphalitis, navel infection and contamination
    - Egg contamination from breeder farm, egg transport, hatchery
    - Unsanitary trays, machines, etc
  - Setter temperature too low
  - Setter or hatcher humidity too high
  - Poor ventilation

Stubby Down

- Signs
  - Short chick down
  - Wiry chick down
- Causes
  - Nutritional deficiencies
    - Riboflavin
- Mycotoxins or other inhibitory toxins
  - Causes nutritional deficiencies
- Incubation temperature too high (day 1 – 14)

Sticky Chicks

- Signs
  - Wet chicks
  - Chicks smeared with albumen
- Causes
  - Setter temperature too low
  - Setter humidity too high
  - Improper turning
  - Old eggs
  - Very large eggs

Chicks Stuck in Shell

- Signs
  - Some chicks stuck in shell
  - Chicks dry
  - Shell fragments stuck to down
- Causes
  - Humidity too low during egg storage, incubation, and/or hatching
  - Improper egg turning
  - Cracked eggs or poor shell quality

Small Chicks

- Sign
  - Chicks too small
- Causes
  - Small eggs
  - Humidity too low during storage or incubation
  - Setter temperature too high
  - Hatchery at high altitude
  - Thin, porous egg shells

Weak Chicks

- Signs
  - Lethargy
  - Poor livability at 7 days
  - Small ruffled and quiet
- Causes
  - Hatcher temperature too high
  - Poor hatcher ventilation
  - Excessive fumigation
  - Contamination

Star Gazers

- Temperature too high
- Egg turning problems
- Genetically related

Red Hocks

- Humidity too high
- Humidity too low
- Difficulty in hatching and exiting egg

Spraddled Legs

- Signs
  - Spraddled legs
  - Crooked toes
- Causes
  - Setter temperature too high or too low
  - Inadequate nutrition
  - Excess humidity
  - Turning racks insufficient
  - Hatchery baskets too smooth

Summary

- Obtain appropriate data and keep good records
- Try and identify flocks or equipment as potential problems and/or eliminate areas that are not a factor

Summary

- Try and determine if any other changes have occurred that may affect the problem
- Make necessary adjustments where needed


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