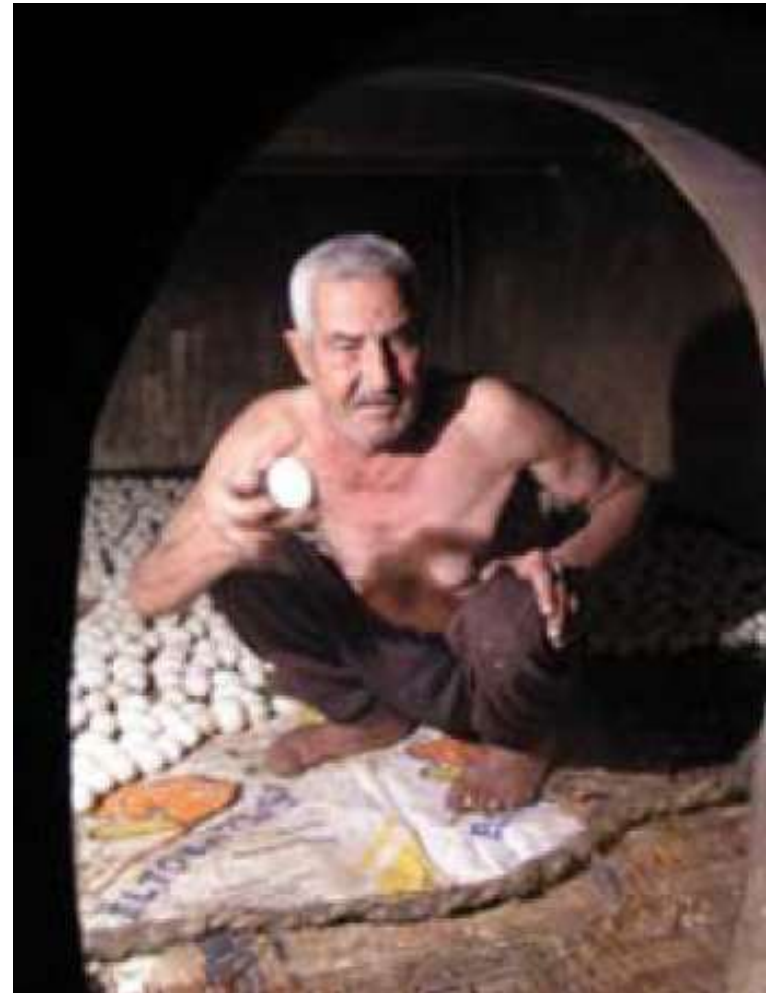
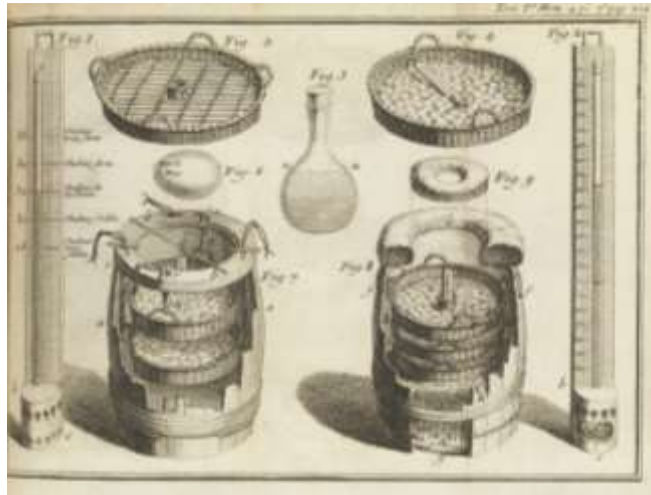




# HATCHERY PROBLEM SOLVING FRAMEWORK

**Dr. Tolga ERKUŞ**  
[www.poultryadvisors.com](http://www.poultryadvisors.com)

# PAST, TODAY, TOMORROW



# PAST, TODAY, TOMORROW



# PAST, TODAY, TOMORROW



# PROBLEMS, INVESTIGATION AND SOLUTIONS

- **Source (Flock & Egg bank)**
- **Incubation (Setters)**
- **Transfer**
- **Hatching (Hatchers)**
- **Chick Processing & Holding**
- **Transport of Chicks**



# PROBLEMS RELATED TO EGG: REASONS/SOLUTIONS





- **Egg Cooling**

- Uneven cooling=Wide hatch window
- Improper cooling=Wide hatch window/early deaths

- **Disinfection/Cleaning**

- Fumigation/Egg wash
- Scraping

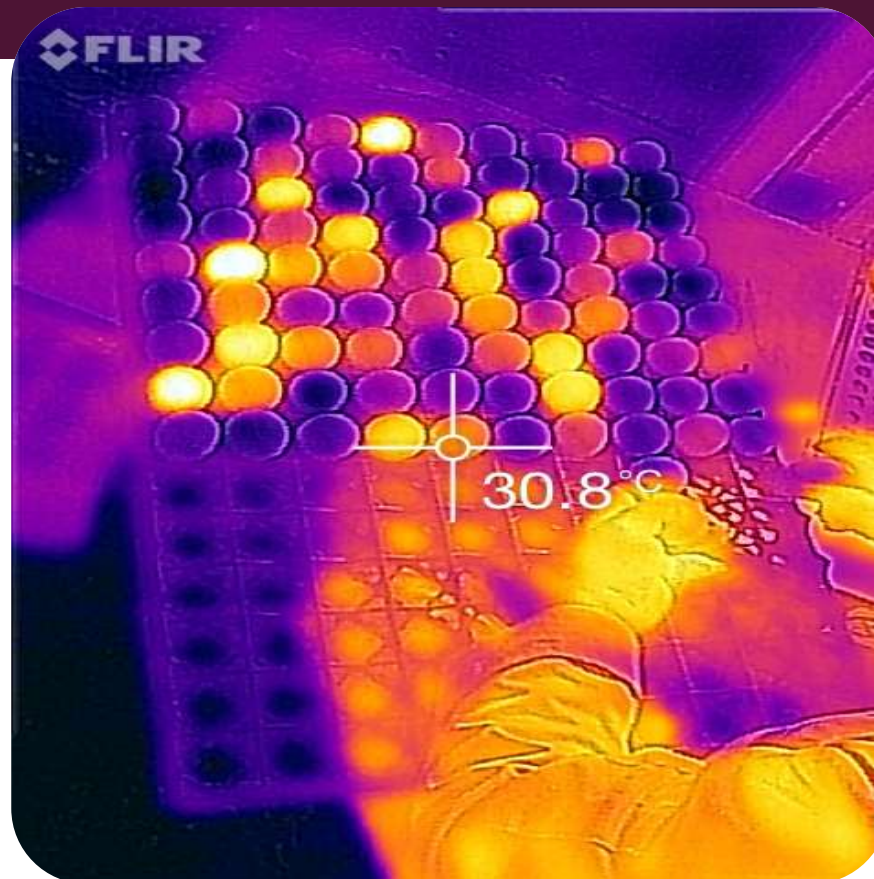
- **Farm storage conditions**

- **Egg transportation**

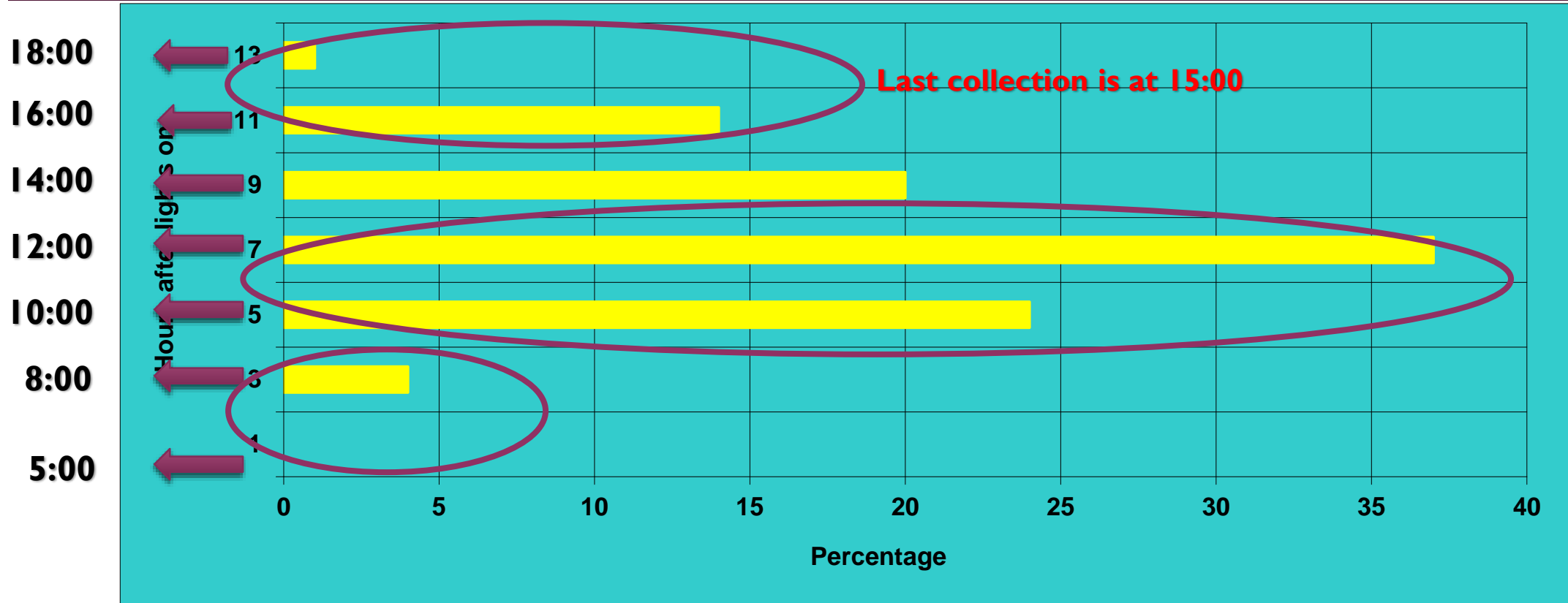
- Vibration
- Temperature fluctuations
- Condensation

# AN EXAMPLE: EGG COLLECTION

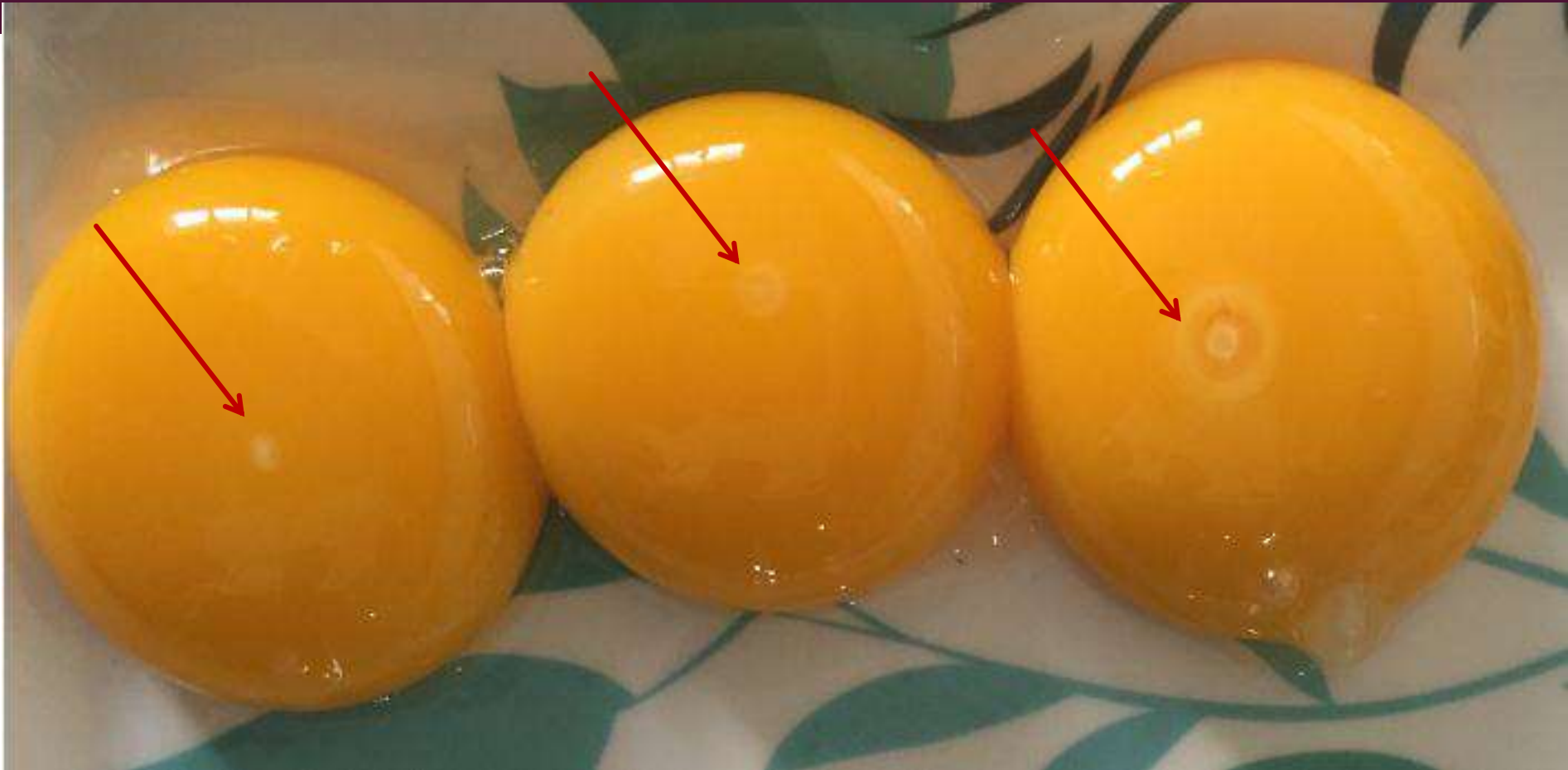
- There were 4 collections:
  - 7:30
  - 10:00
  - 13:00
  - 15:00
  
- 5:00 to 19:00 lights on



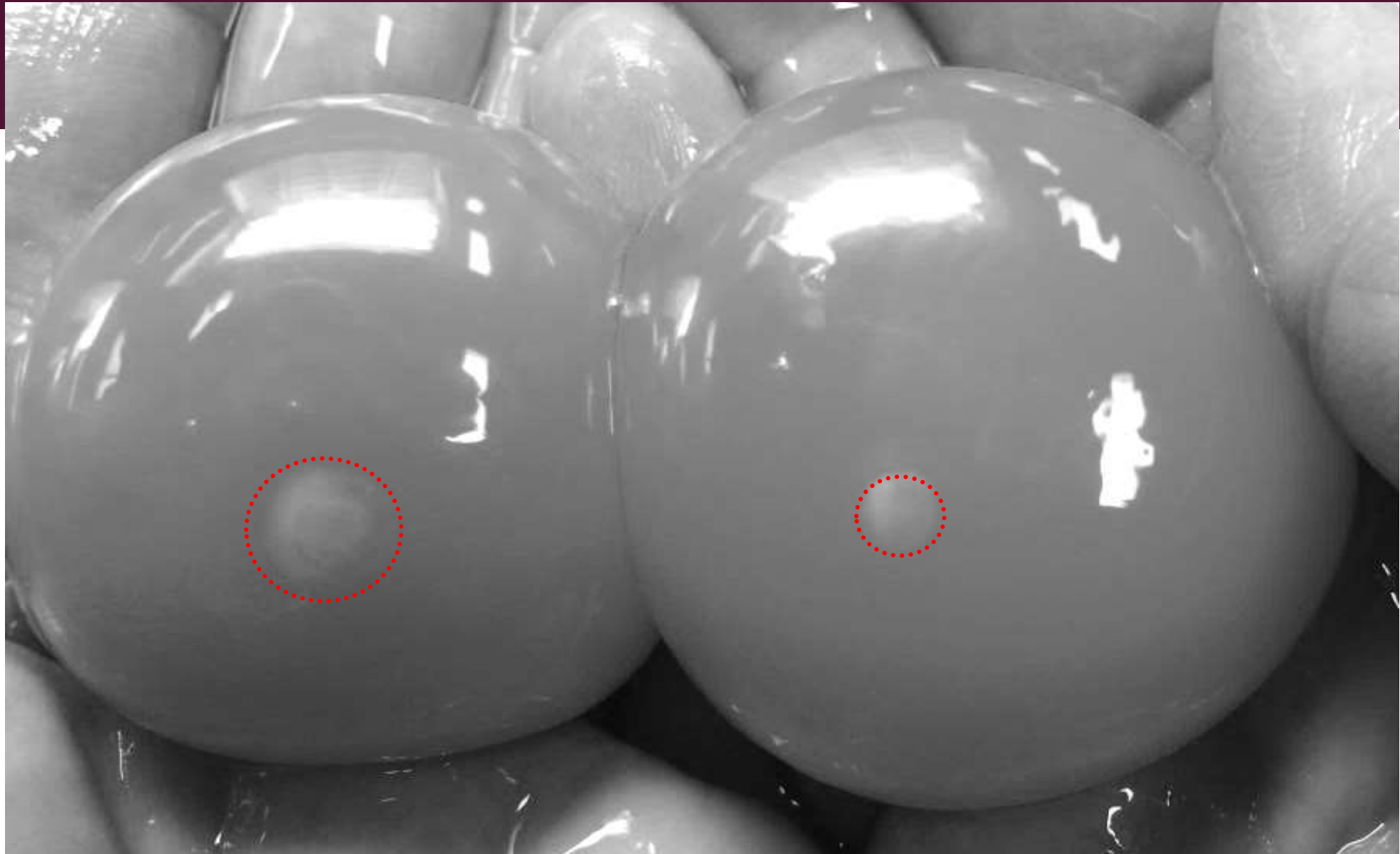
# ARE COLLECTION TIMES CORRECT?



# DIFFERENT SIZE OF BLASTODERM

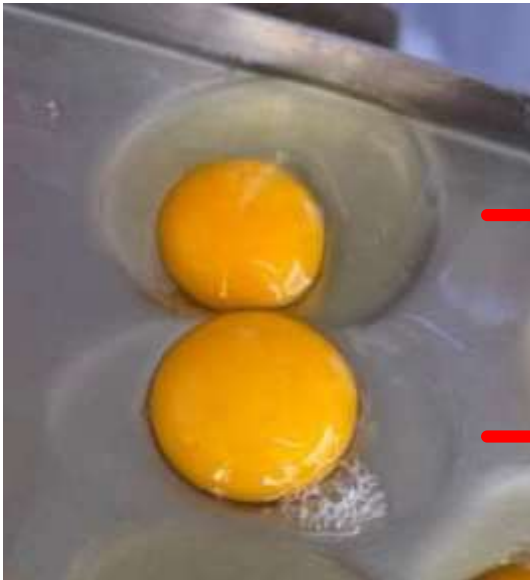






## Egg size and Flock Age

- **Yolk size correlates with flock age, not egg weight:** Setting very young flock eggs can cause low hatchability and poor chick quality problems even for large eggs. Yolk size follows flock age more than egg weight. (Ex: 50g egg from the young flock will have much smaller yolk than 50g egg from older flock). Avoid using very young flocks for 50g eggs, as small yolks impact hatchability and chick quality.



Large egg from young flock

Small egg from prime flock

Same egg weight,  
different flock age!!!

**Early use of eggs not always profitable and can cause uniformity, mortality and performance problems**

# WHAT CAN WE DO TO CONTROL CONTAMINATION?

- Set floor, dirty or washed eggs in a separate setter, and hatch them in a separate hatcher
- If not possible, set at bottom trays and hatch separately
- *Invite the farm manager in to help with candling & transfer if there are a lot of bangers*
- Fumigate the hatchers as the chicks pip the shells (look for a rise in humidity to assess timing)

AT FARM



**At Hatchery**



# BACTERIAL COUNTS ON HATCHING EGG SHELL SURFACE

- Newly laid egg – 300 bacteria/cm<sup>2</sup>
- Cooled clean egg – 3,000 bacteria/cm<sup>2</sup>
- “Clean” floor egg – 30,000 bacteria/cm<sup>2</sup>
- Dirty egg – 300,000 bacteria/cm<sup>2</sup>



# EGG CHECK WITH UV LIGHTS

- Washed/liquid contacted eggs
- Disinfected eggs
- Wiped eggs
- Scraped/sanded eggs
- Floor/clean looking floor eggs
- Damaged cuticle/no cuticle eggs

## USE OF UV



## CUTICLE UNDER UV LIGHT



# CLEAN LOOKING DIRTY EGGS!!!





a

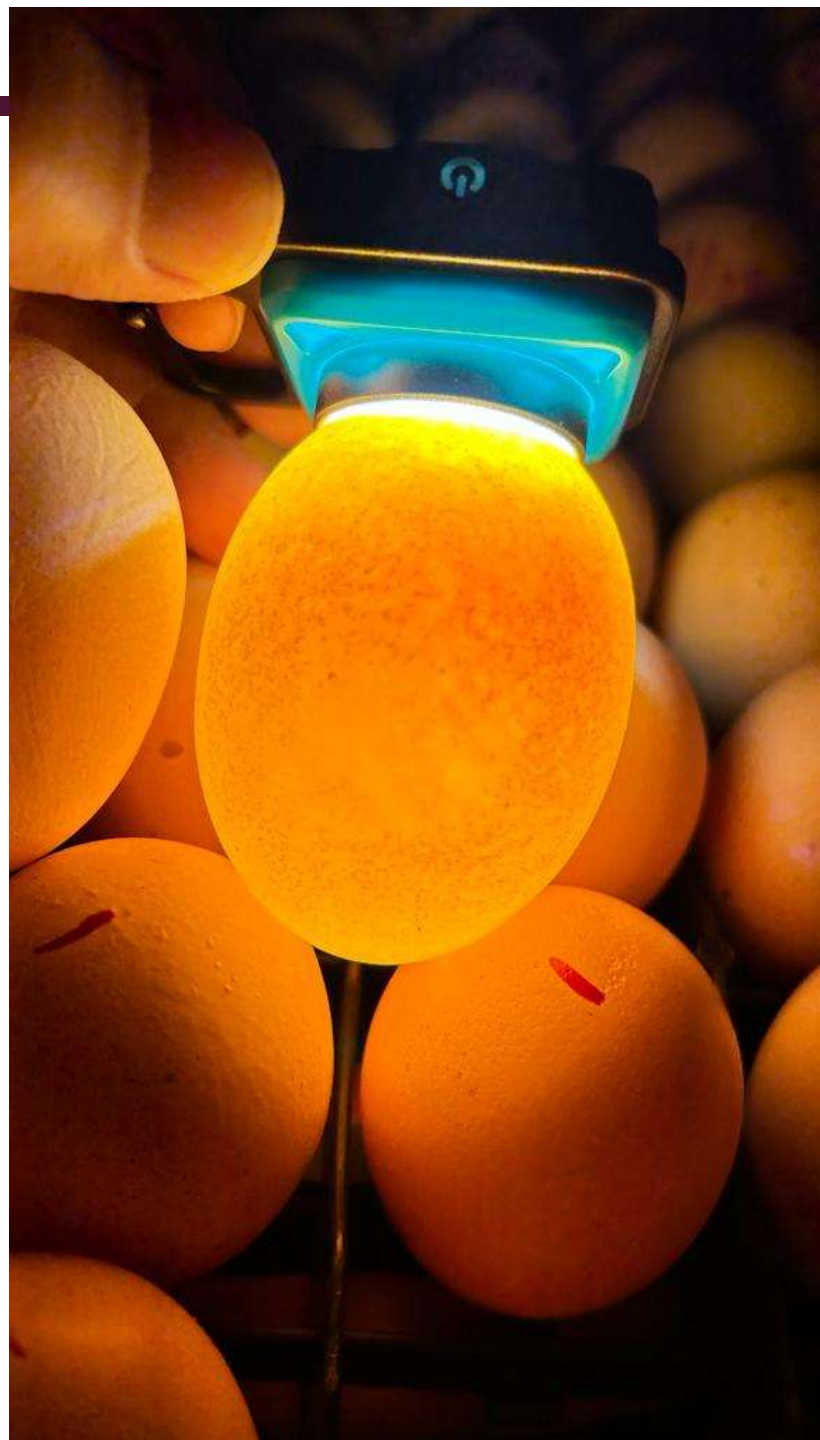


o



# A REAL EXAMPLE





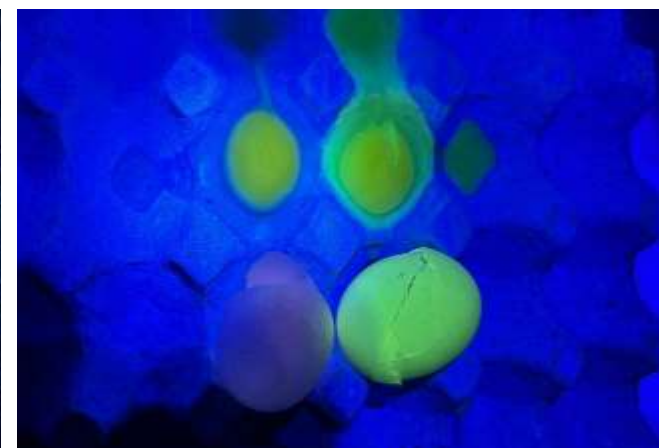


???

Antibiotics?

Toxins?

Disease?



# EGG COOLING AND STORAGE

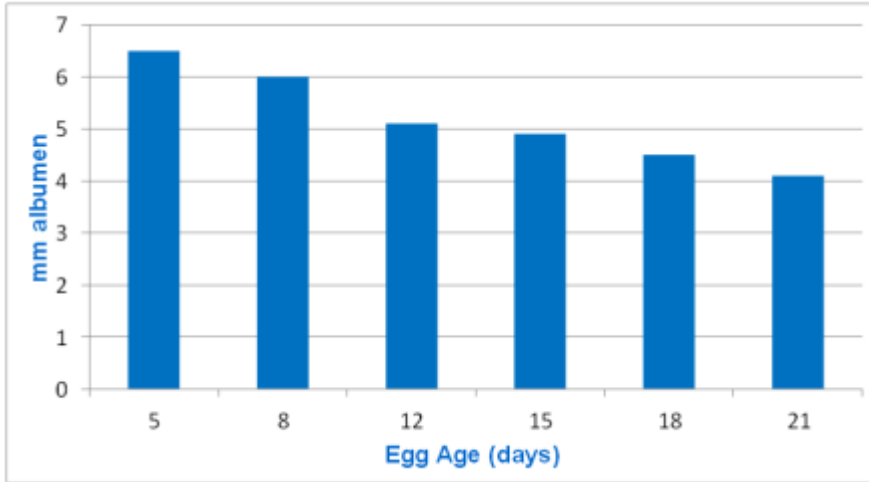


# GUIDELINE FOR EGG STORAGE

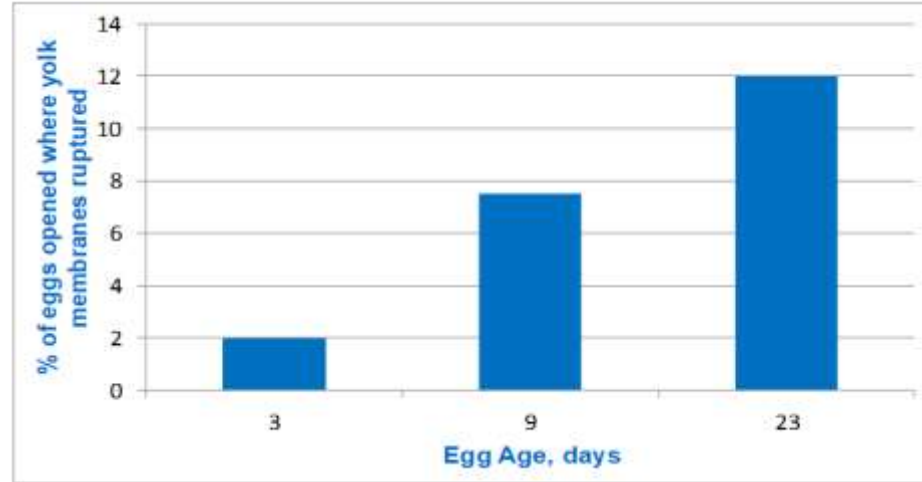
- Eggs should be cooled to below 21°C soon after collection from the nest boxes on farm
- The farm egg stores should run about 1-2°C higher than storage at hatchery – be careful with condensation
- It is important to keep the egg storage temperature constant

# WHAT HAPPENS DURING STORAGE?

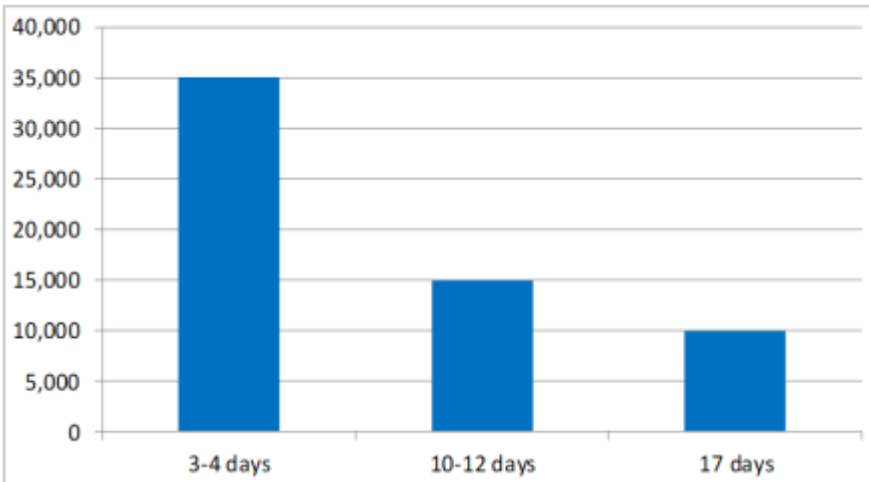
## Albumen height decreased



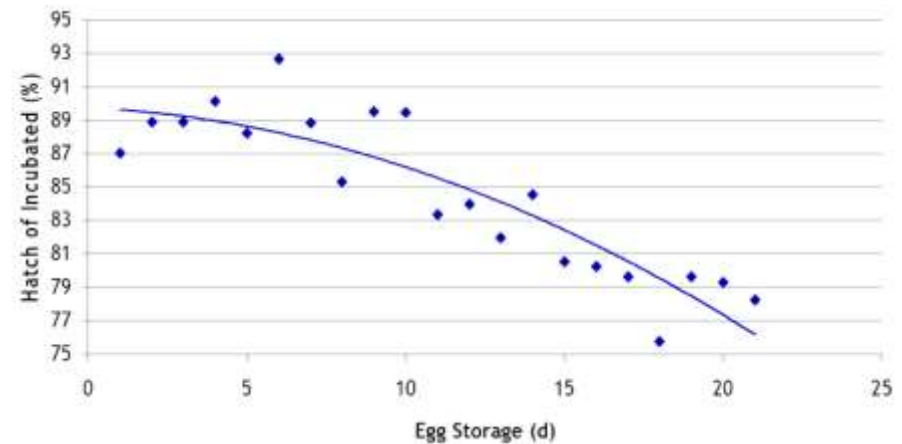
## Yolk become more fragile



## Number of living cells decreased



## Hatchability decreased



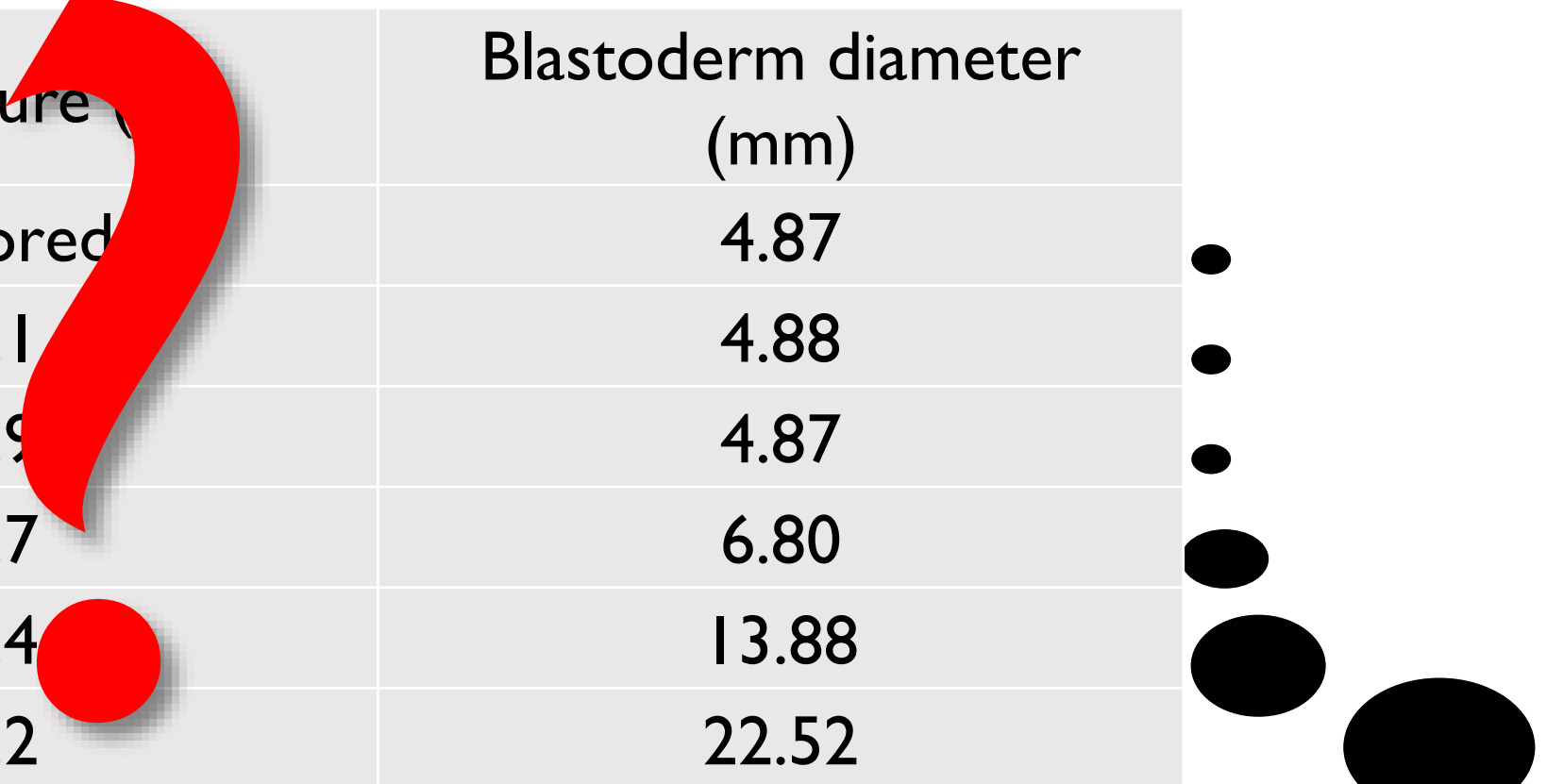
# PHYSIOLOGICAL ZERO

Bramwell et al. (2003)

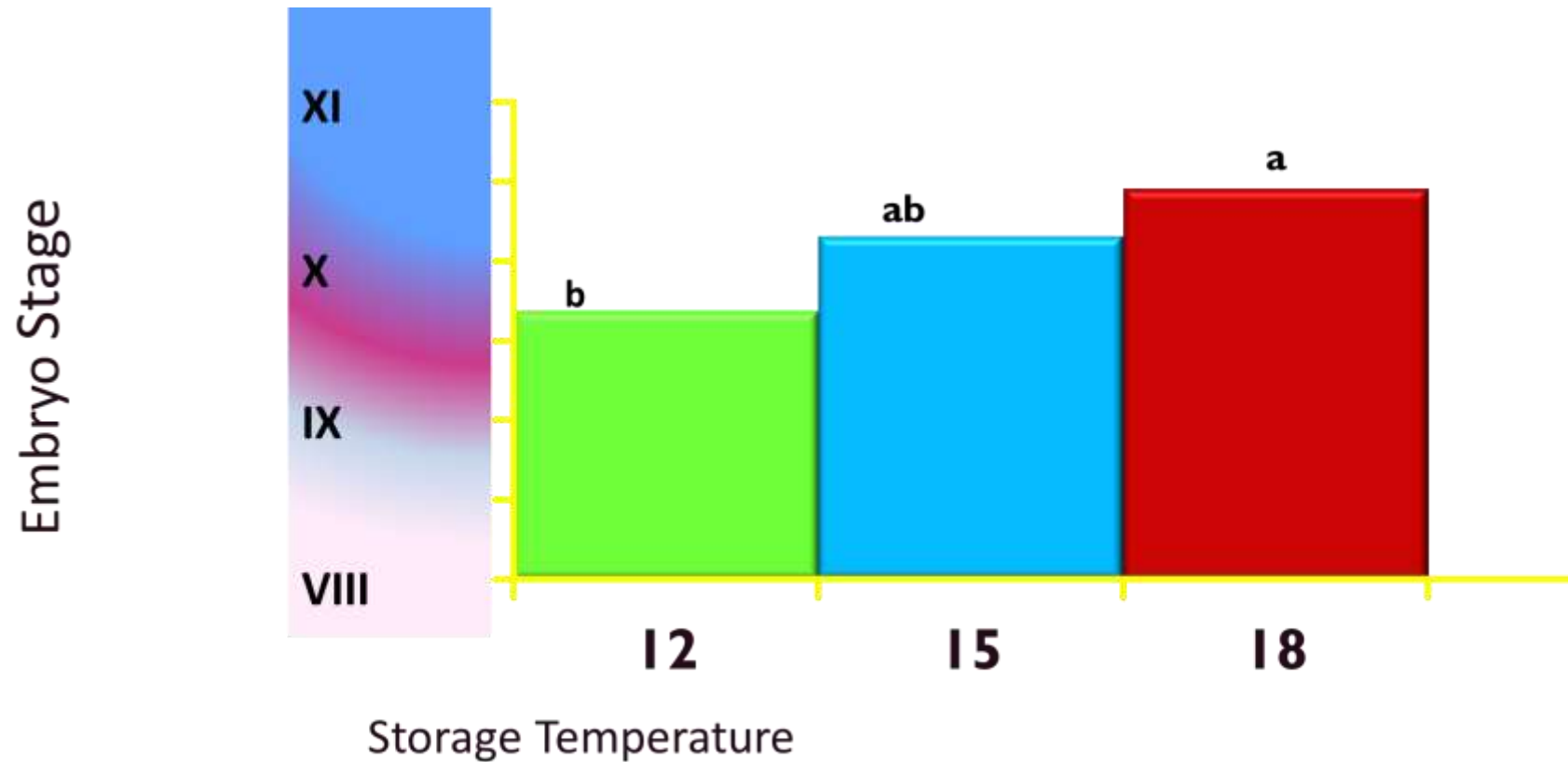
Poultry Science Association Meeting, Madison, Wisconsin

Mean blastoderm diameters in broiler breeder eggs stored for 0 to 4 days at various temperatures

Temperature (°C)	Blastoderm diameter (mm)
Unstored	4.87
21.1	4.88
23.9	4.87
26.7	6.80
29.4	13.88
32.2	22.52



# EMBRYONIC DEVELOPMENT



@5d

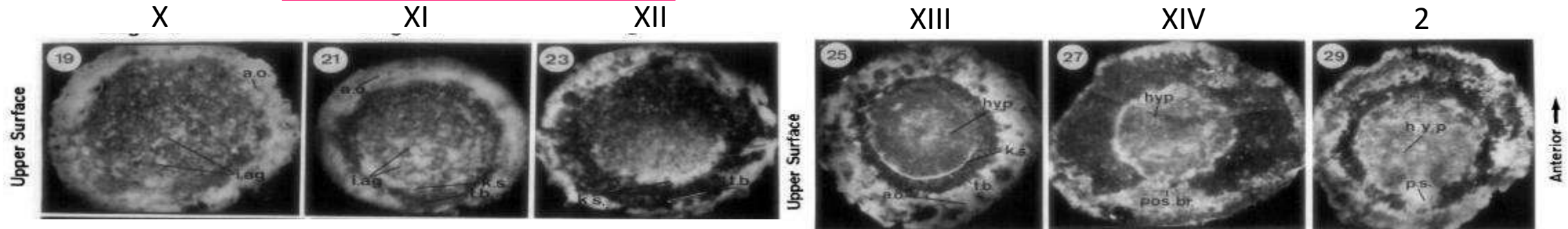
# EMBRYO DEVELOPMENT

Oviposition

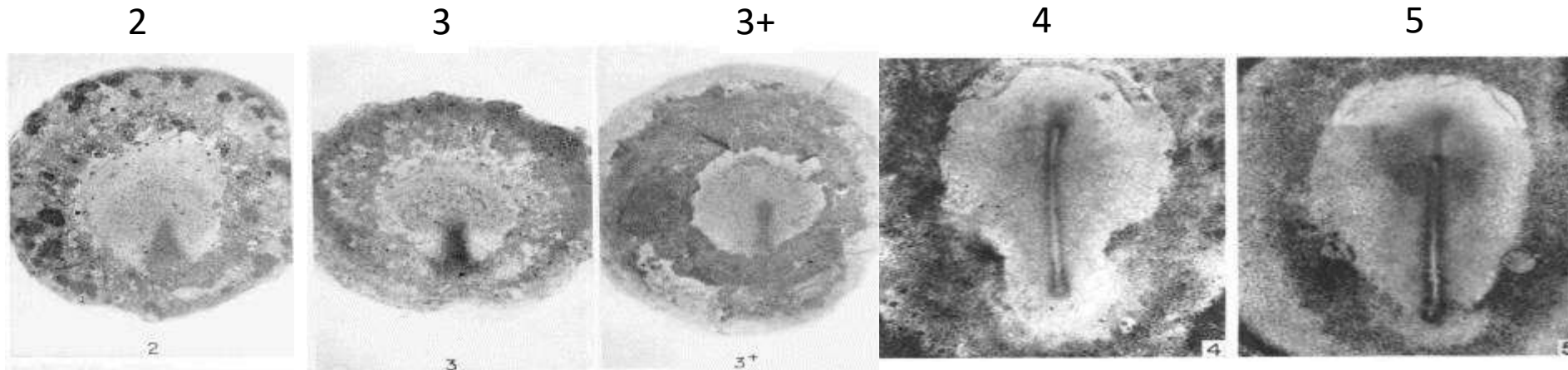
XI-XII: Coalescing cells progress from partial to crescent shaped hypoblast

Hypoblast complete

Onset of primitive streak formation

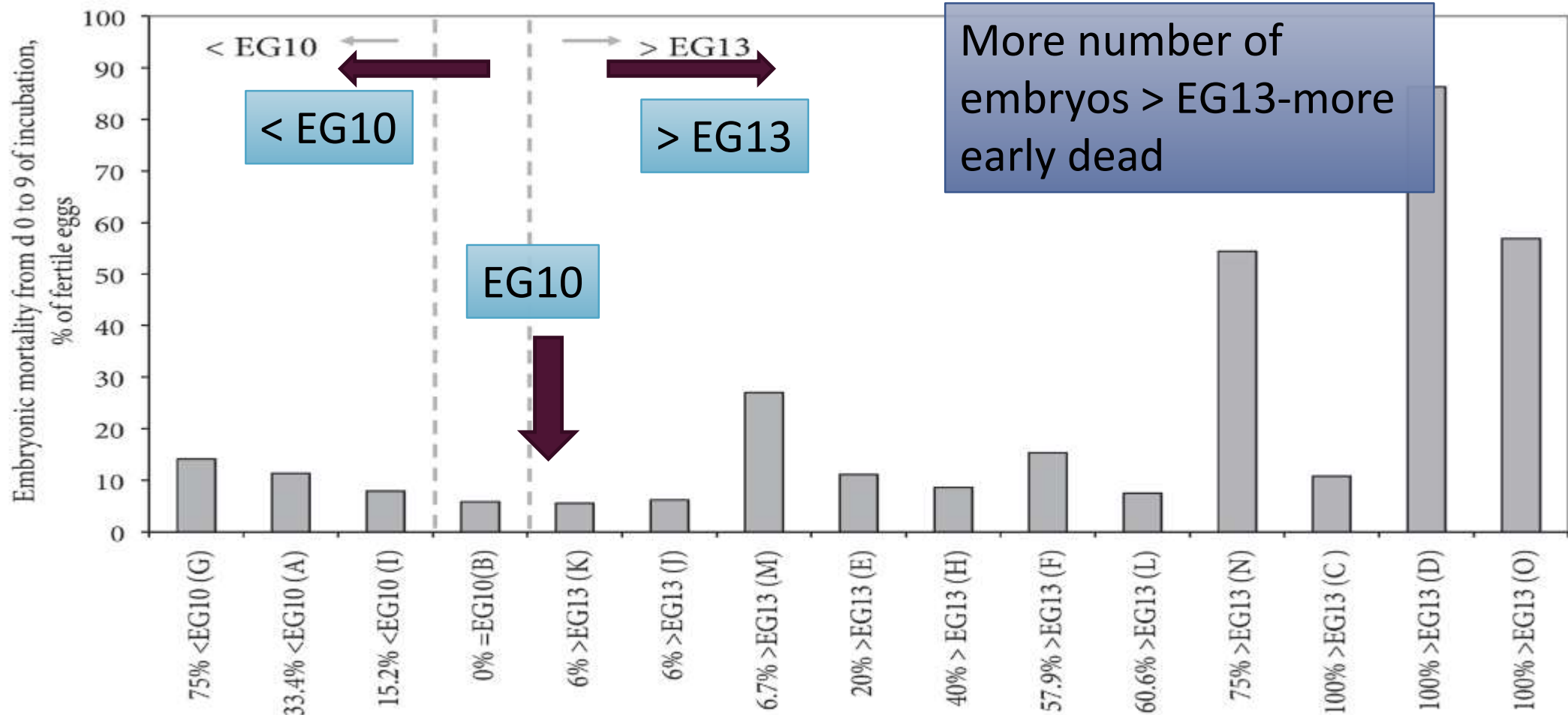


Roman, Eyal-Giladi & Kochav, 1976 Arabic, Hamburger & Hamilton, 1951



Staging can be used as a quality control

# EGG HANDLING/STORAGE – EMBRYO STAGE AND EARLY DEAD FROM DAY 0-9 OF INCUBATION



# SYNCHRONIZING THE HATCH

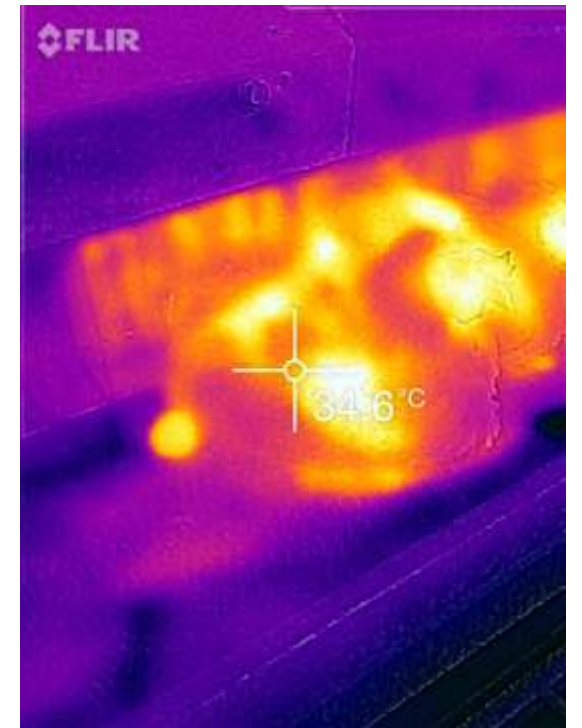


## 24 HOURS INCUBATED EMBRYOS



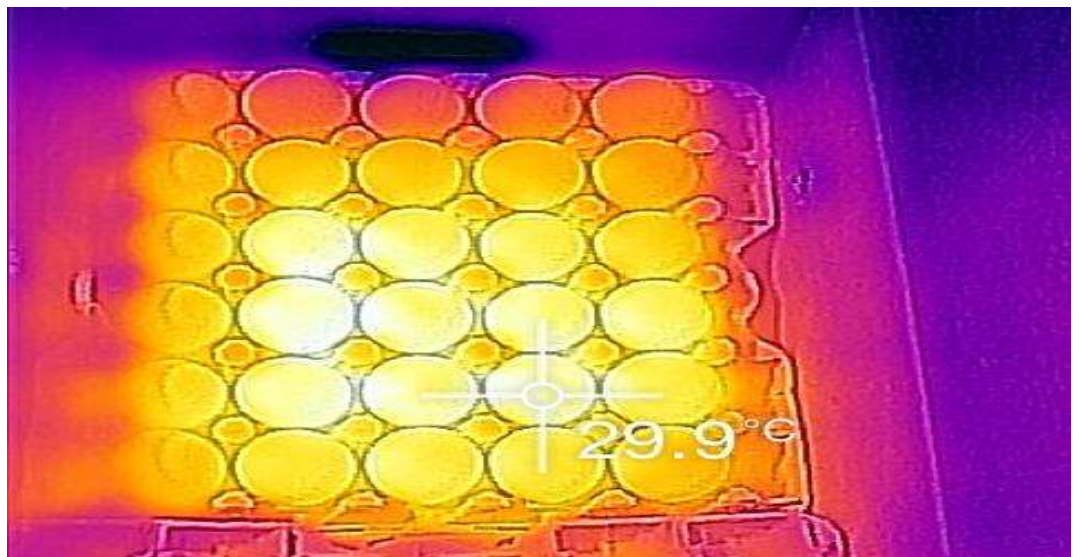
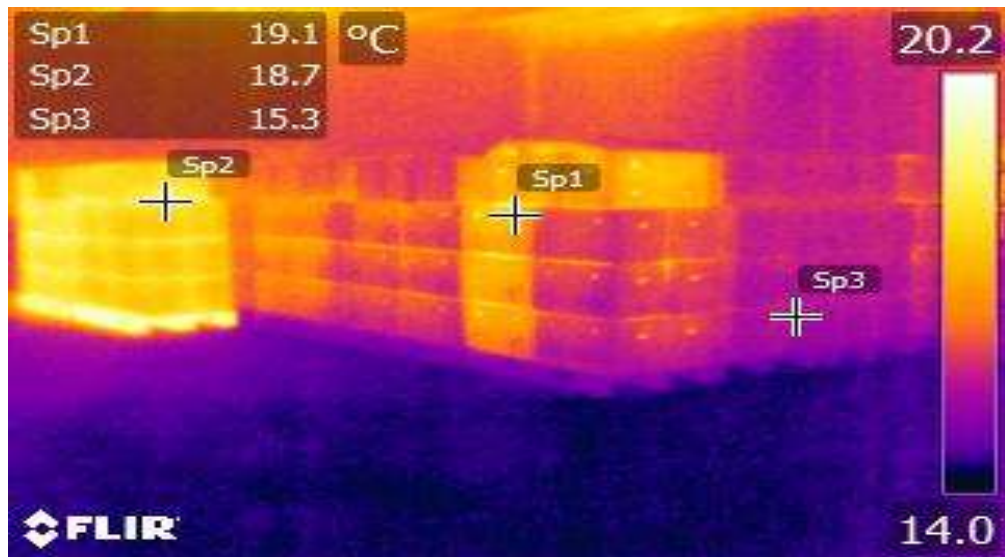
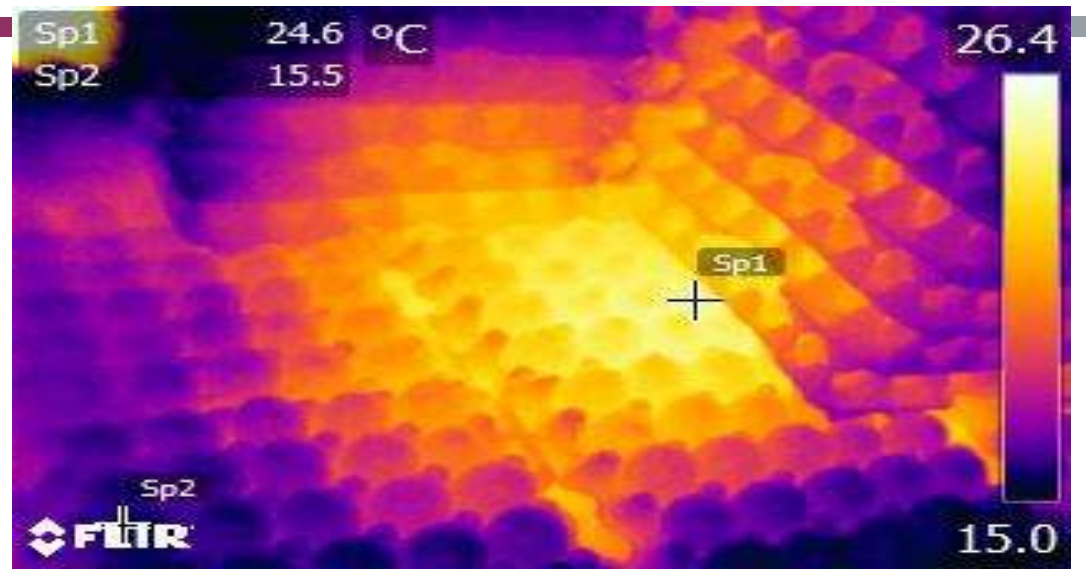
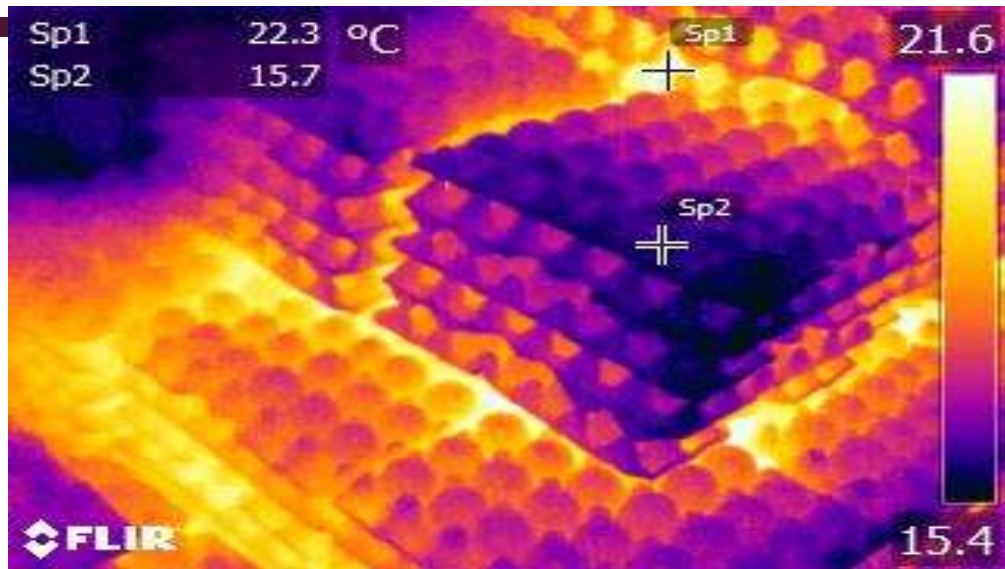
Cool down the eggs evenly to avoid variation of embryonic development!

# EGGS STUCK IN THE NEST



# POINTS TO WATCH

- If eggs are still warm when they are collected, then they need the chance to cool down evenly
- Ideally, pack eggs directly onto setter trays, which are then placed on spaced racks or buggies to allow air flow across the eggs as they cool

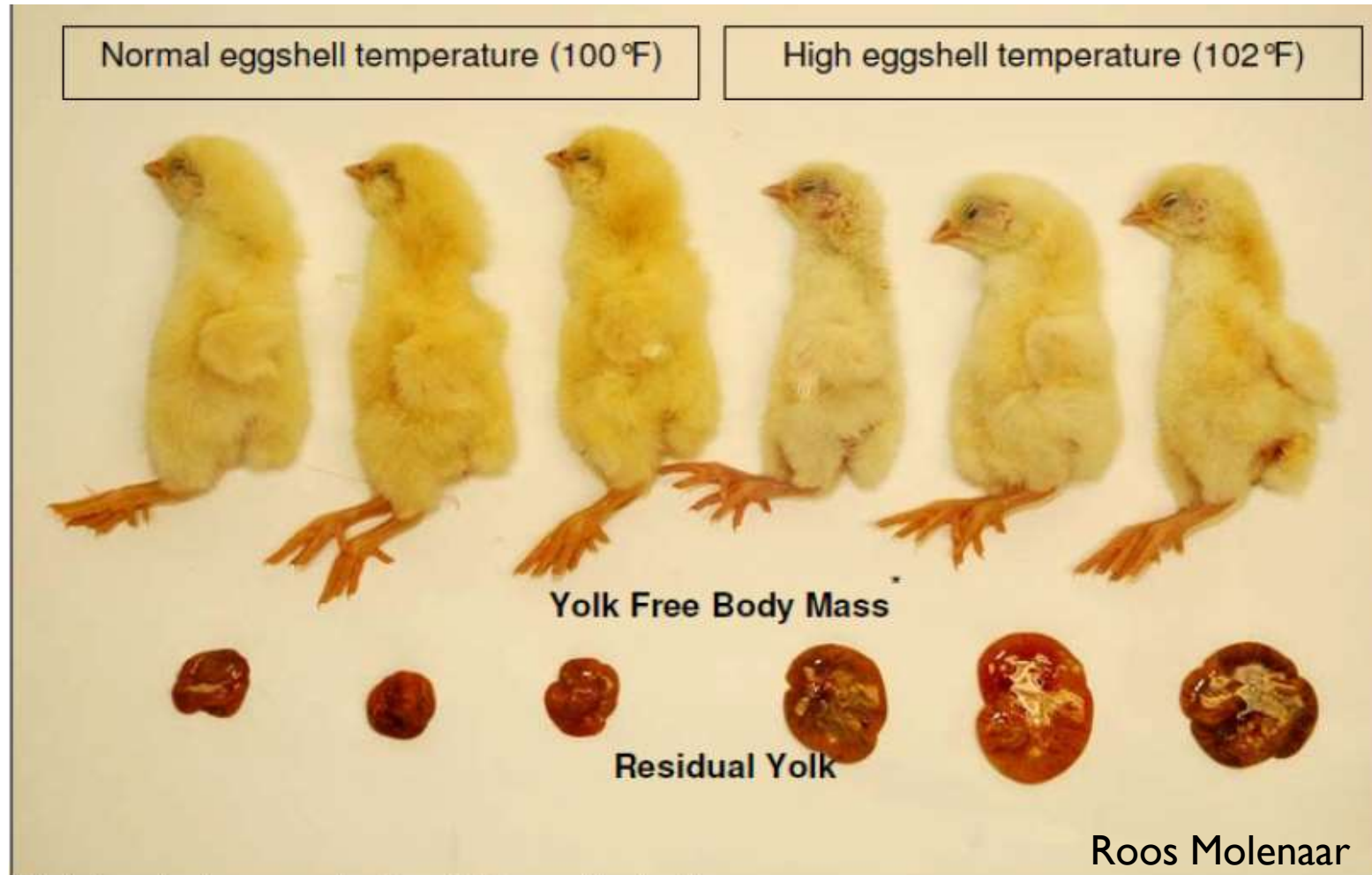


# INCUBATION PRACTICE

- Eggshell temperature
- Total incubation times
- Hatcher profiles
- Chick processing
- Holding and planning of delivery



# HIGH TEMPERATURE



\* Yolk free body mass = body weight – residual yolk

# Effects of Temperature During Incubation

- Abnormal incubation temperatures affect organ development of avian embryos.
- High EST is often resulting in:
  - Decreased chick weight at hatch
  - Higher residual yolk weight
  - Decrease in heart size
  - Decrease in proventriculus, gizzard, and small intestines
  - Poor bone development

# YOLK UTILISATION



# TEMPERATURE AND EFFECTS ON HEART WEIGHT

Wineland (2001):	17% reduction
Lourens et al (2005):	33% reduction
Leksrisompong et al. (2008)	17% reduction
Molenaar et al, (2011)	26% reduction
Ipek et al (2014)	30% reduction
Maatjens et al (2014)	15% reduction
Nangsuay et al (2016)	23% reduction

*Approx 20-25% reduction by 2 °F higher temperature*

## Consequences on later life?

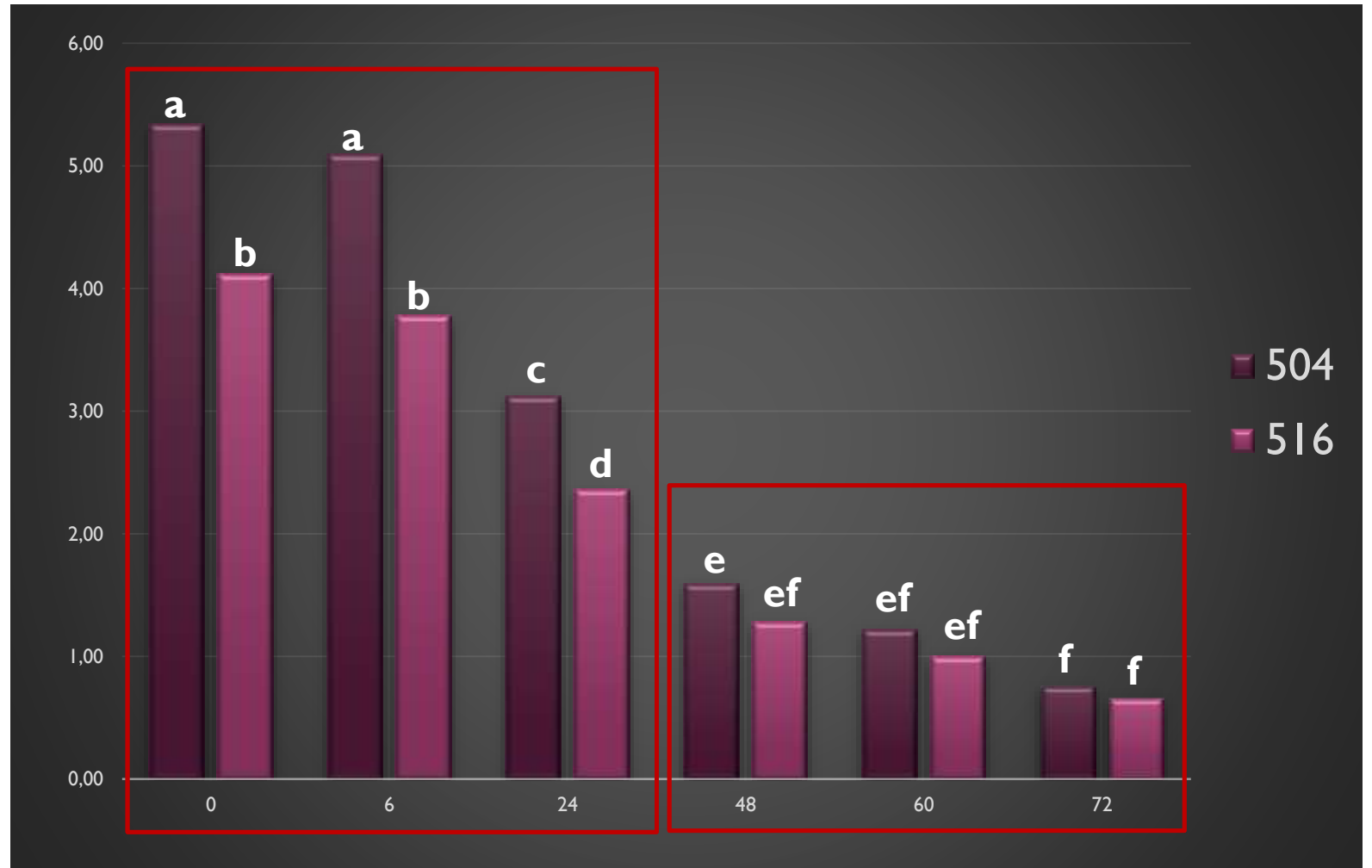
## PULL TIME AND HOLDING TIME EFFECT

- Total incubation time has a big influence on chick yield and belly problems
- Green chicks at hatch can have a big impact on feeding and drinking behaviours of chicks.
- Holding and transporting conditions can ruin chick quality easily
- Final body weights and mortalities can be effected by placement times



## Effects of pull time and Pre-placement holding time on YFBM and RYS (g and percentage) of chicks

<sup>a-g</sup> Percentages of chicks in a column with different superscripts differ significantly ( $P \leq 0.05$ )



Treatment	Crop Fill Progression of Chicks <sup>1</sup>				
	Empty	Water	Feed	Full, rounded	Total
	------(%)-----				
Pull time (h)					
504	3.33 <sup>a</sup>	7.57	6.19	82.90 <sup>b</sup>	100.0
516	0.56 <sup>b</sup>	6.78	5.22	87.44 <sup>a</sup>	100.0
Pre-Placement holding time (h)					
6	8.61 <sup>a</sup>	15.28 <sup>a</sup>	14.72 <sup>a</sup>	61.39 <sup>c</sup>	100.0
24	0.28 <sup>b</sup>	8.33 <sup>b</sup>	5.28 <sup>b</sup>	86.11 <sup>b</sup>	100.0
48	0.56 <sup>b</sup>	3.89 <sup>b</sup>	5.56 <sup>b</sup>	90.00 <sup>ab</sup>	100.0
60	0.28 <sup>b</sup>	5.04 <sup>b</sup>	1.59 <sup>c</sup>	93.10 <sup>a</sup>	100.0
72	0.00 <sup>b</sup>	3.33 <sup>b</sup>	1.39 <sup>c</sup>	95.28 <sup>a</sup>	100.0
Pull time × Pre-Placement time (h)					
504	6	15.56 <sup>a</sup>	13.33	54.44 <sup>e</sup>	100.0
	24	0.00 <sup>b</sup>	7.78	87.22 <sup>abc</sup>	100.0
	48	1.11 <sup>b</sup>	6.11	86.67 <sup>bc</sup>	100.0
	60	0.00 <sup>b</sup>	6.75	91.19 <sup>abc</sup>	100.0
	72	0.00 <sup>b</sup>	3.89	95.00 <sup>ab</sup>	100.0
516	6	1.67 <sup>b</sup>	17.22	68.33 <sup>d</sup>	100.0
	24	0.56 <sup>b</sup>	8.89	85.00 <sup>c</sup>	100.0
	48	0.00 <sup>b</sup>	1.67	93.33 <sup>ab</sup>	100.0
	60	0.56 <sup>b</sup>	3.33	95.00 <sup>ab</sup>	100.0
	72	0.00 <sup>b</sup>	2.78	95.56 <sup>a</sup>	100.0

Treatment	Observation at 1 h <sup>1</sup>		Observation at 3 h		Observation at 8 h	
	Eating	Drinking	Eating	Drinking	Eating	Drinking
	----- (%) -----					
Pull time (h)						
504	23.65	9.06 <sup>b</sup>	22.02	9.60 <sup>b</sup>	14.02	6.48
516	23.79	11.71 <sup>a</sup>	23.90	11.40 <sup>a</sup>	15.56	7.52
Pre-Placement holding time (h)						
6	12.76 <sup>b</sup>	8.70 <sup>b</sup>	14.90 <sup>b</sup>	7.45 <sup>c</sup>	7.81 <sup>b</sup>	6.56 <sup>b</sup>
24	26.15 <sup>a</sup>	9.70 <sup>b</sup>	26.20 <sup>a</sup>	15.47 <sup>a</sup>	15.63 <sup>a</sup>	9.90 <sup>a</sup>
48	25.73 <sup>a</sup>	10.94 <sup>ab</sup>	24.27 <sup>a</sup>	11.56 <sup>b</sup>	16.35 <sup>a</sup>	6.46 <sup>b</sup>
60	28.80 <sup>a</sup>	12.81 <sup>a</sup>	26.09 <sup>a</sup>	9.27 <sup>bc</sup>	16.15 <sup>a</sup>	5.37 <sup>b</sup>
72	25.16 <sup>a</sup>	9.79 <sup>b</sup>	23.33 <sup>a</sup>	8.75 <sup>c</sup>	18.02 <sup>a</sup>	6.72 <sup>b</sup>

<sup>a-d</sup> Percentages of chicks in a column with different superscripts differ significantly ( $P \leq 0.05$ ).

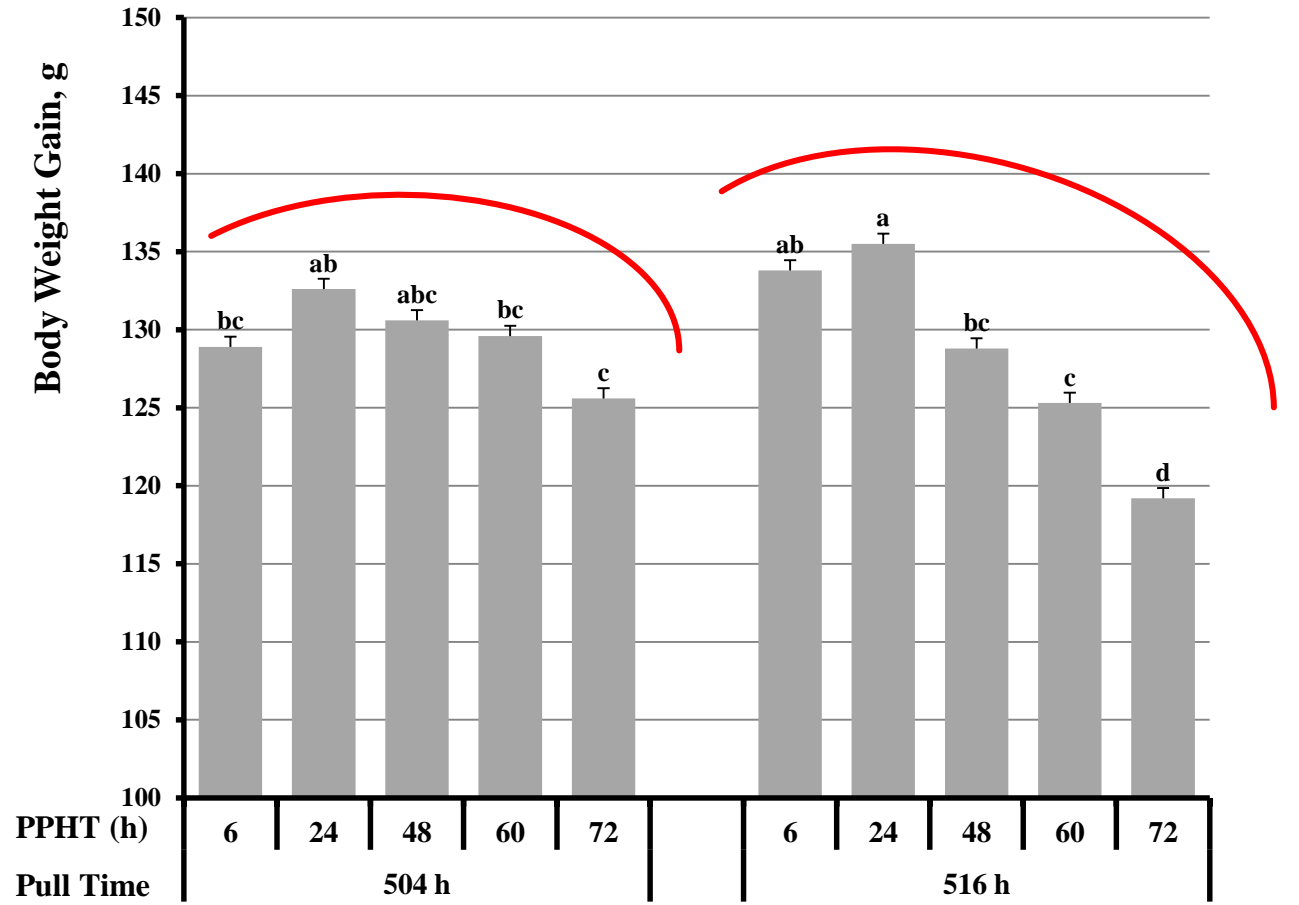
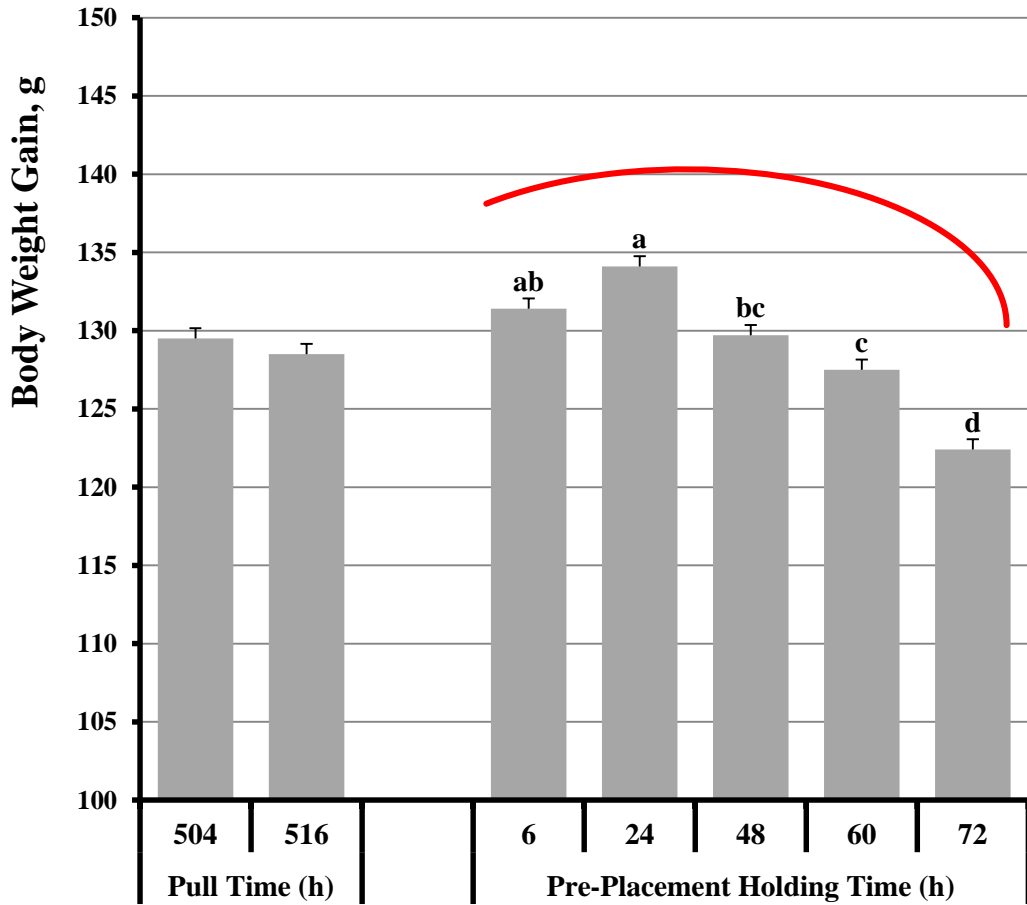
<sup>1</sup> The percentage of behaviors which eating from the feeder and chicken paper or water drinking from the nipples at 3 h or 8 h after placement.

Body weight and mortality of chicken from placement to 7 d of placement.



Treatment		0 d		7 d	
		------(g)-----			
Pull time (h)					
504		42.16 <sup>a</sup>		171.6 <sup>a</sup>	
516		40.45 <sup>b</sup>		169.0 <sup>b</sup>	
Pre-Placement holding time (h)					
	6	44.82 <sup>a</sup>		176.2 <sup>a</sup>	
	24	43.08 <sup>b</sup>		177.1 <sup>a</sup>	
	48	41.04 <sup>c</sup>		170.7 <sup>b</sup>	
	60	39.64 <sup>d</sup>		167.1 <sup>c</sup>	
	72	37.95 <sup>e</sup>		160.3 <sup>d</sup>	
Pull time × Pre-Placement time (h)					
504	6	45.68		174.6 <sup>bc</sup>	} 6=48
	24	43.96		176.6 <sup>ab</sup>	
	48	41.85		172.4 <sup>cd</sup>	
	60	40.61		170.2 <sup>de</sup>	
	72	38.70		164.3 <sup>f</sup>	
516	6	43.95		177.8 <sup>a</sup>	} 6>48
	24	42.19		177.7 <sup>a</sup>	
	48	40.23		169.0 <sup>e</sup>	
	60	38.68		164.0 <sup>f</sup>	
	72	37.19		156.4 <sup>g</sup>	

504>516  
~6-8g extra

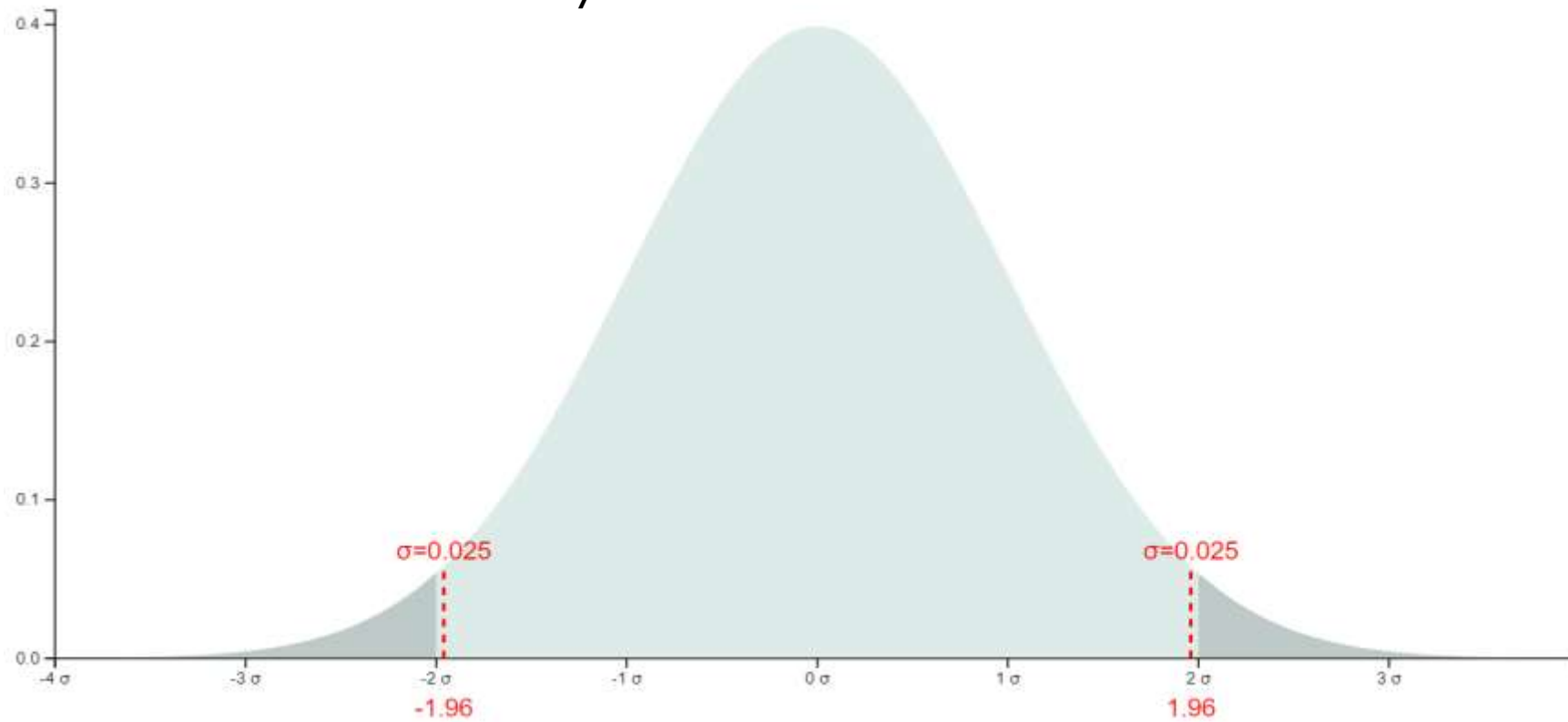


Treatment	Mortality				
	0-3 d	4-7 d	0-7 d	Pattern	
	----- (%) -----				
Pull time (h)					
504	0.63	0.31	0.94	>	
516	0.69	0.35	1.04	>	
Pre-Placement holding time (h)					
6	0.16 <sup>b</sup>	0.42	0.57 <sup>b</sup>	<	
24	0.31 <sup>b</sup>	0.21	0.52 <sup>b</sup>	~	
48	0.73 <sup>b</sup>	0.16	0.89 <sup>b</sup>	>	
60	0.63 <sup>b</sup>	0.52	1.15 <sup>b</sup>	~	
72	1.46 <sup>a</sup>	0.36	1.82 <sup>a</sup>	>	
Pull time × Pre-Placement time (h)					
504	6	0.21	0.52	0.73	<
	24	0.42	0.10	0.52	>
	48	0.73	0.21	0.94	>
	60	0.73	0.52	1.25	>
	72	1.04	0.21	1.25	>
516	6	0.10	0.31	0.42	<
	24	0.21	0.31	0.52	~
	48	0.73	0.10	0.83	>
	60	0.52	0.52	1.04	~
	72	1.88	0.52	2.40	>

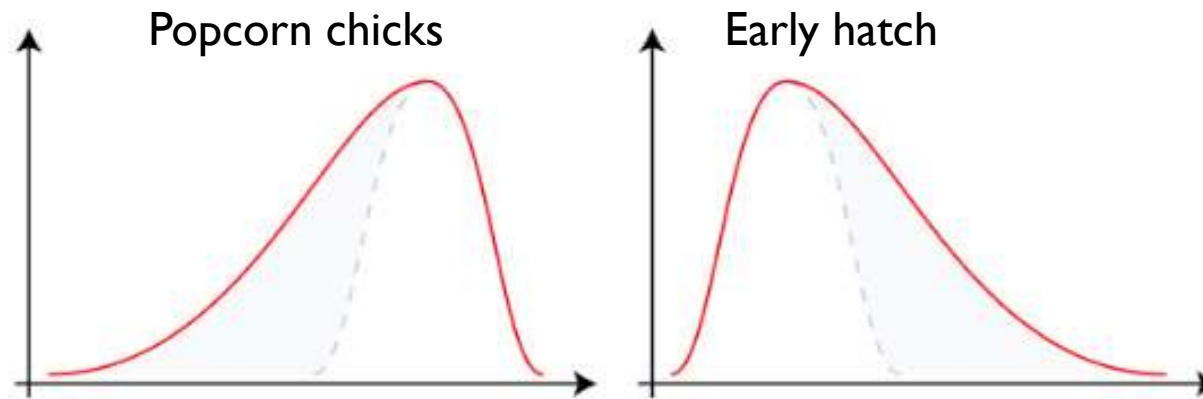
- 
- No significant differences in the absolute RYS weight between chicks that were fed versus those held without access to feed with a maximum holding period of 72 h after the pull time.
  - Body weight at placement, decreased with longer durations. However, body weight at 7 d after placement was greater in the 24 h holding time group than in shorter (6 h) or longer (48, 60, and 72 h) preplacement holding time groups
    - \*\*\*Green Chicks\*\*\*
  - Shorter incubation times are more suitable for long-distance deliveries, longer incubation times are more suitable for short-distance deliveries
    - \*\*\*CY%, Hatcher Set Temperatures\*\*\*
  - Mortality, as a direct indicator of flock health and welfare, was not affected by preplacement holding times of 60 h or less under optimum conditions
  - UNDER OPTIMAL CONDITIONS, CHICKS ARE ALL FINE UP TO 60 HOURS 😊

# STAGE SHIFTING TIMES IN HATCHERS

Humidity shows a normal distribution

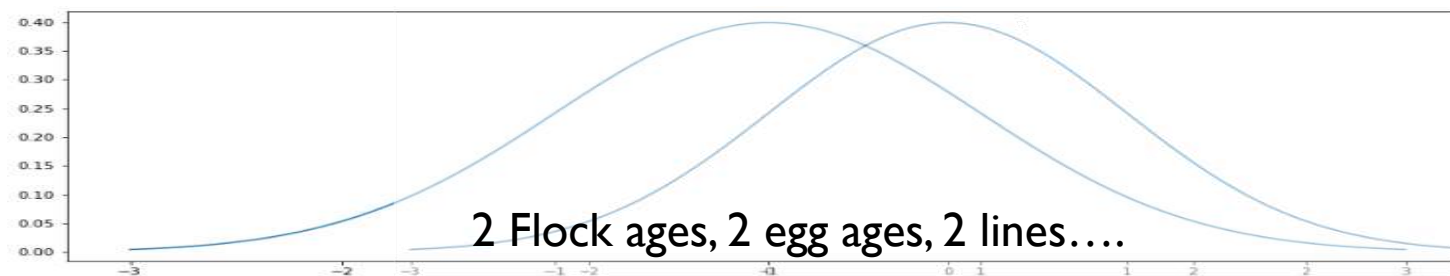
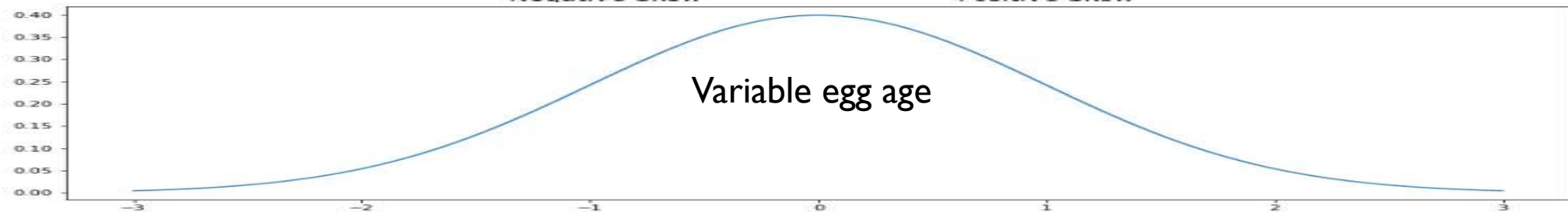


# OTHER POSSIBILITIES

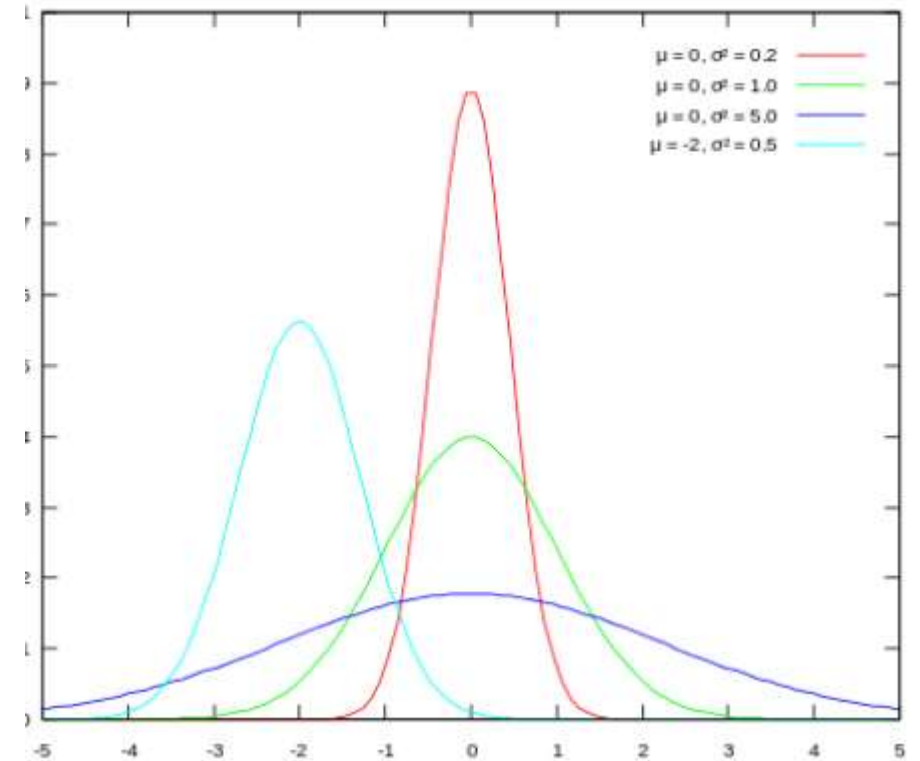
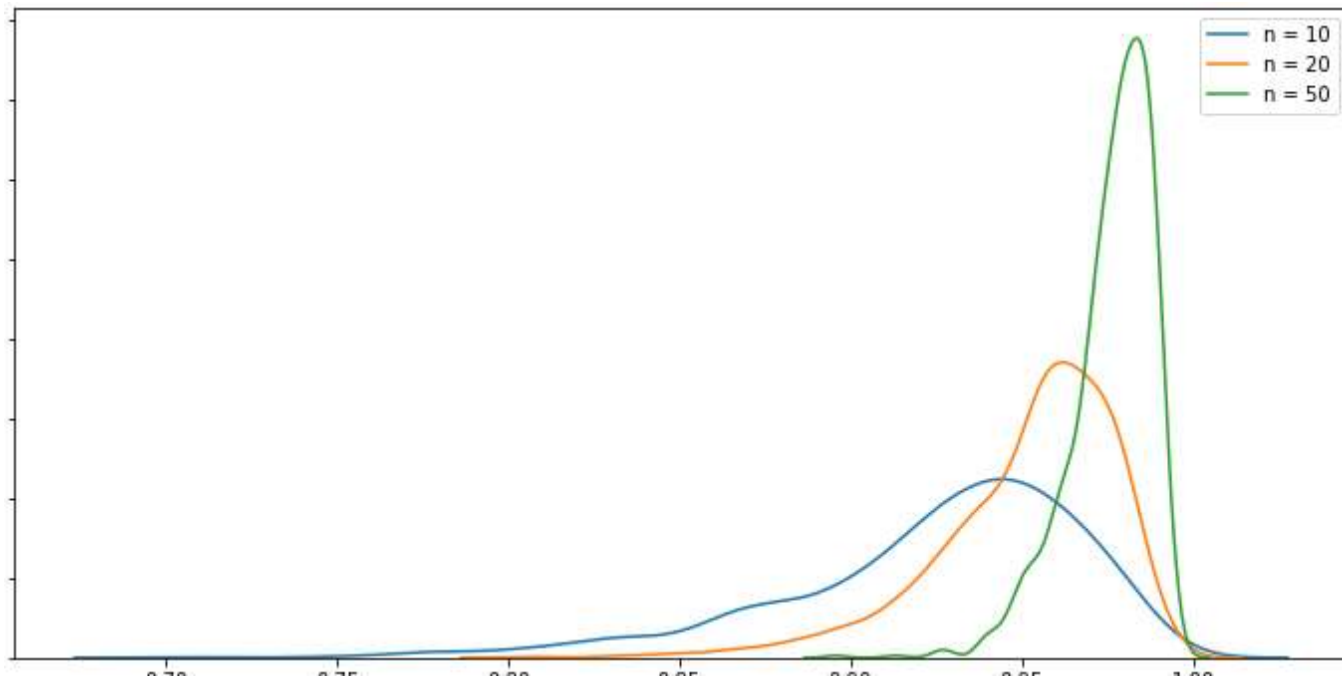


Negative Skew

Positive Skew

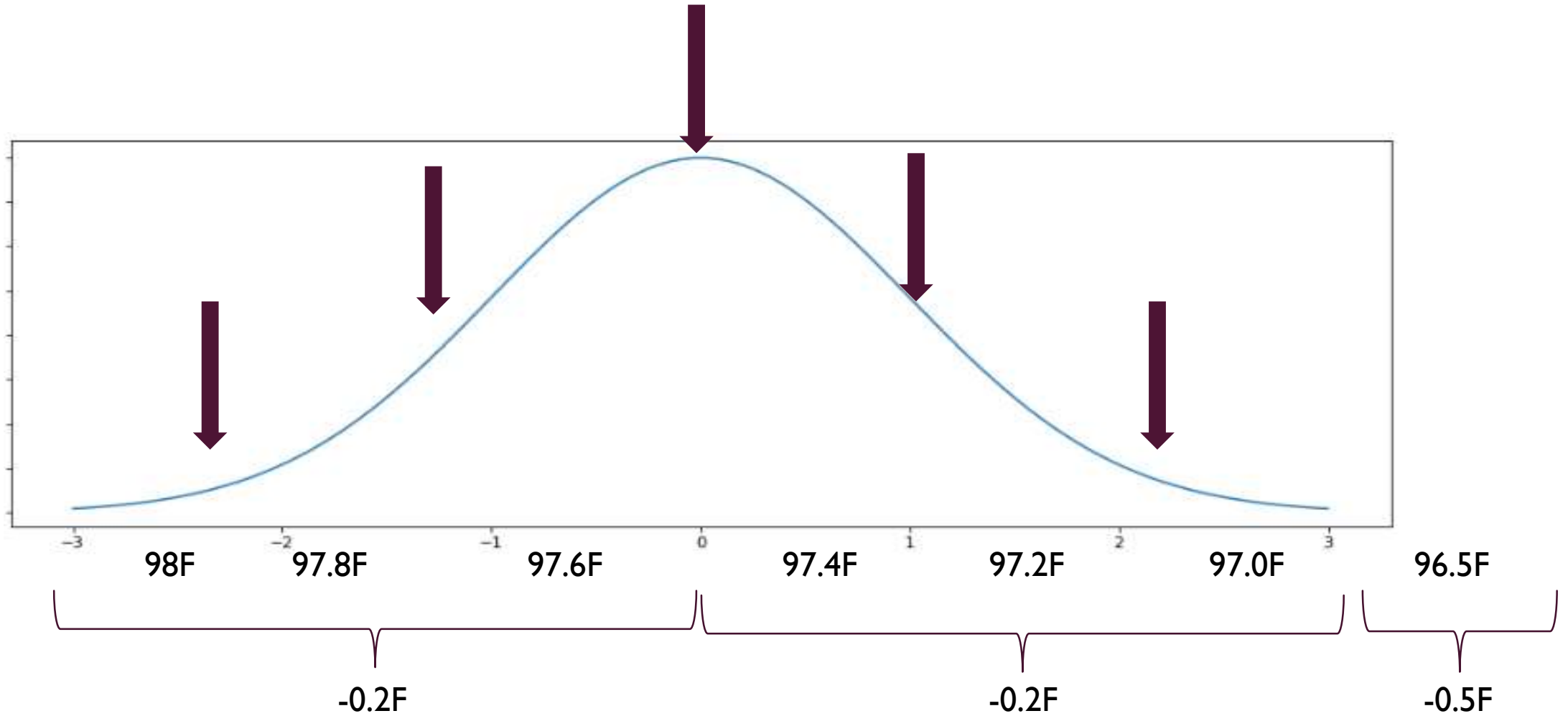


# HIGH DENSITY + MULTIPLE FLOCKS

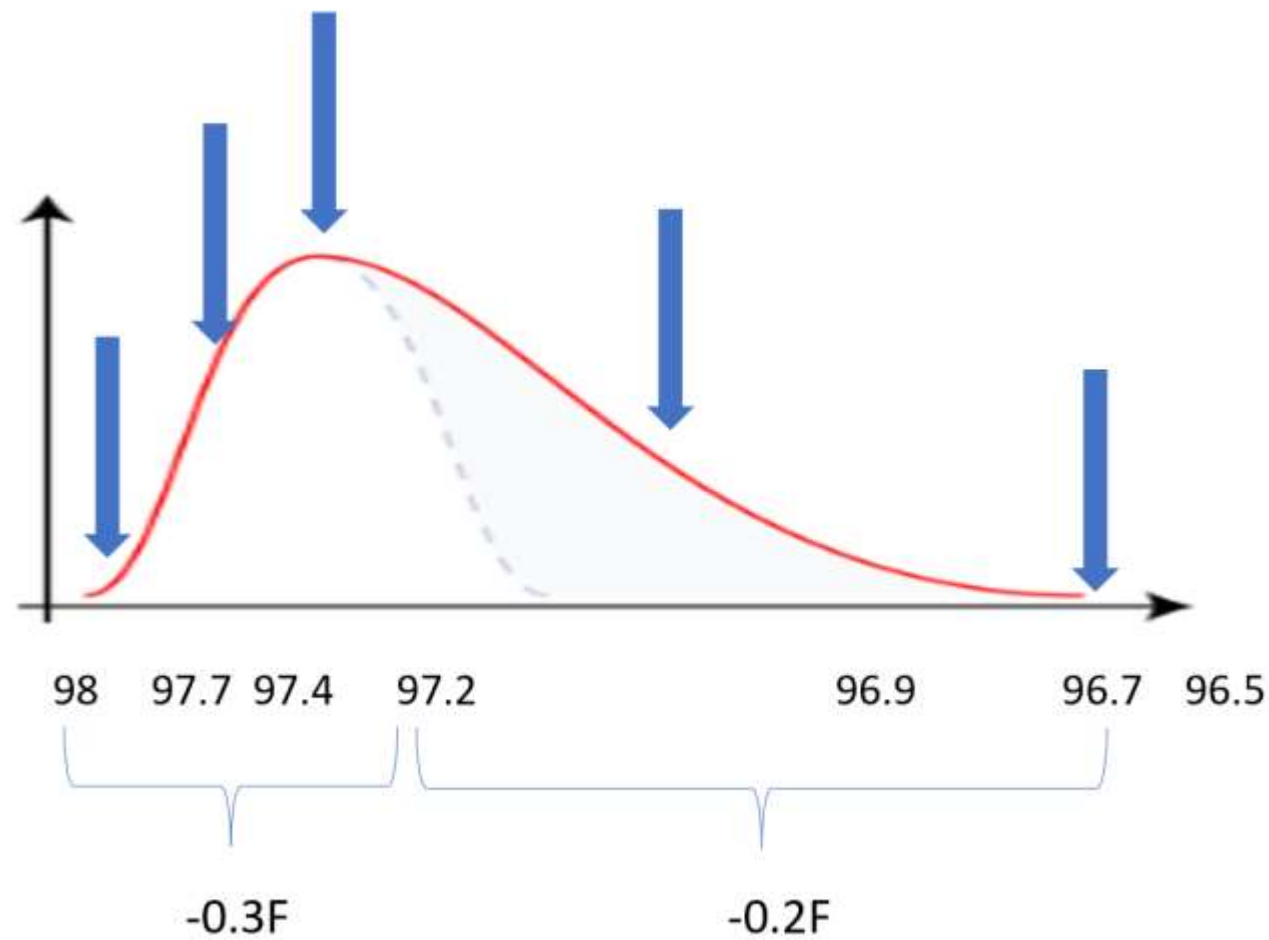
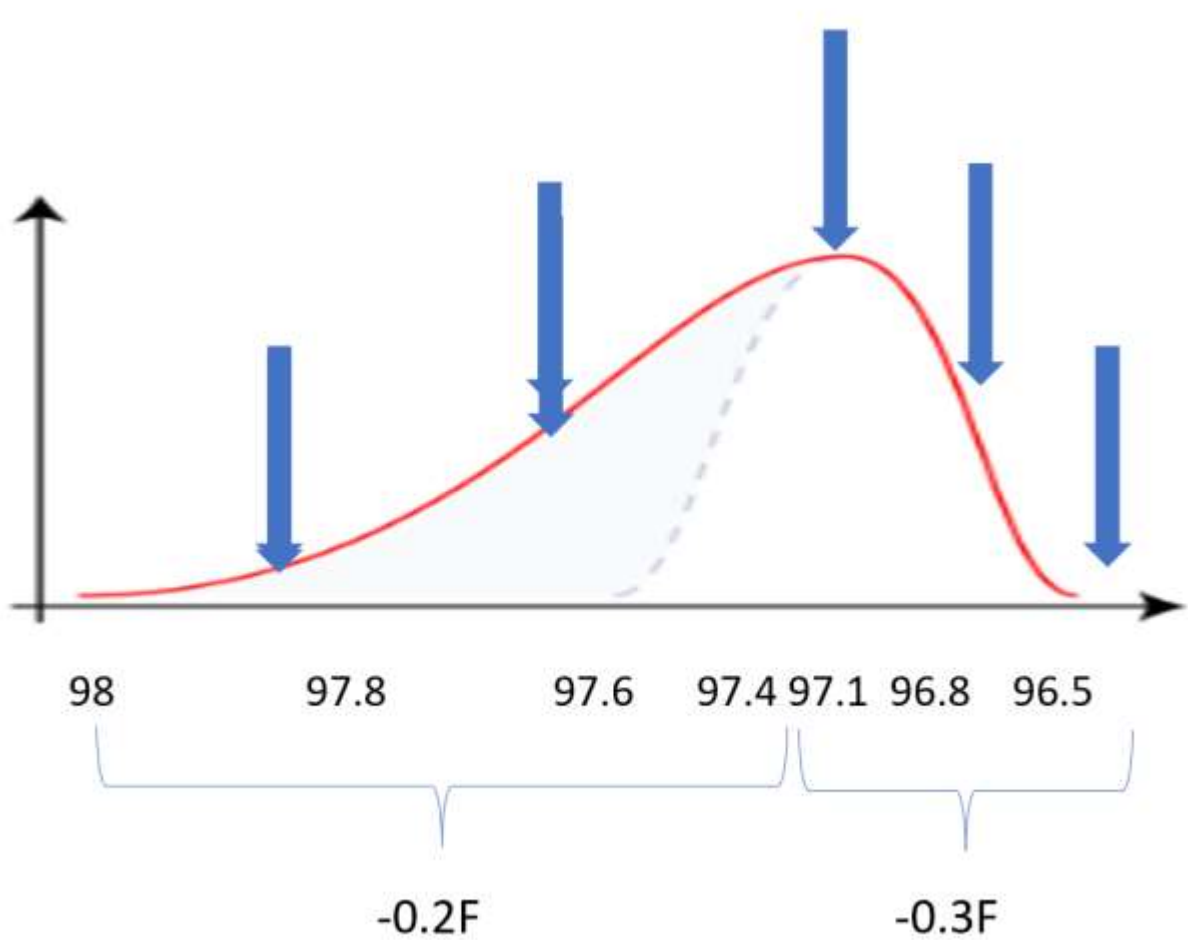


Dehydration, green chicks, contamination, chick quality issues, sexer damages.....

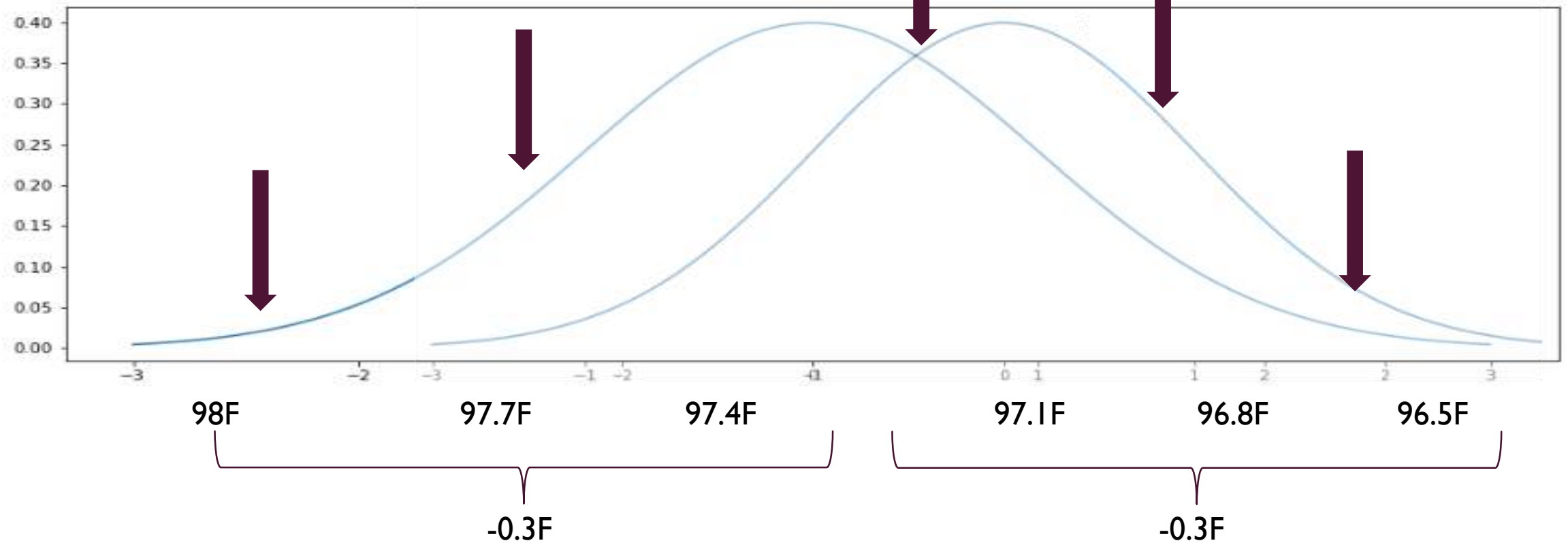
# A SOLUTION SIMILAR TO MODERN SYSTEMS



# A SOLUTION SIMILAR TO MODERN SYSTEMS

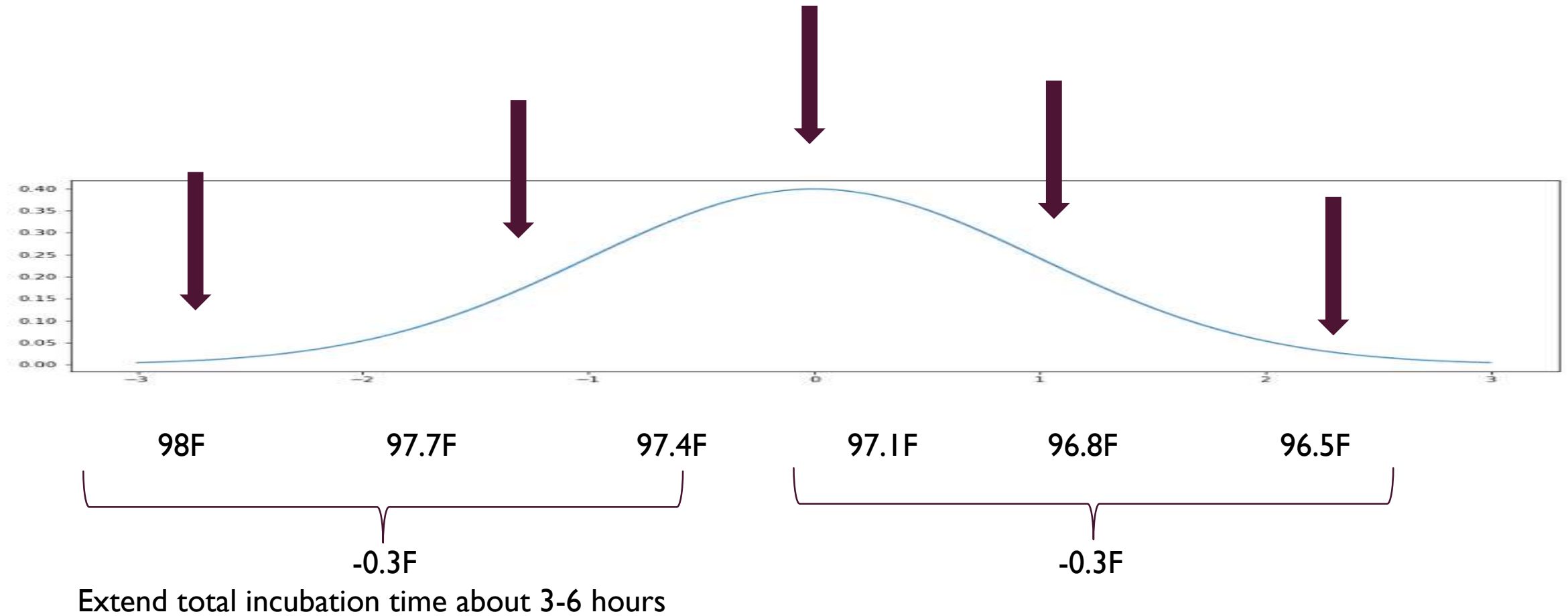


# A SOLUTION SIMILAR TO MODERN SYSTEMS

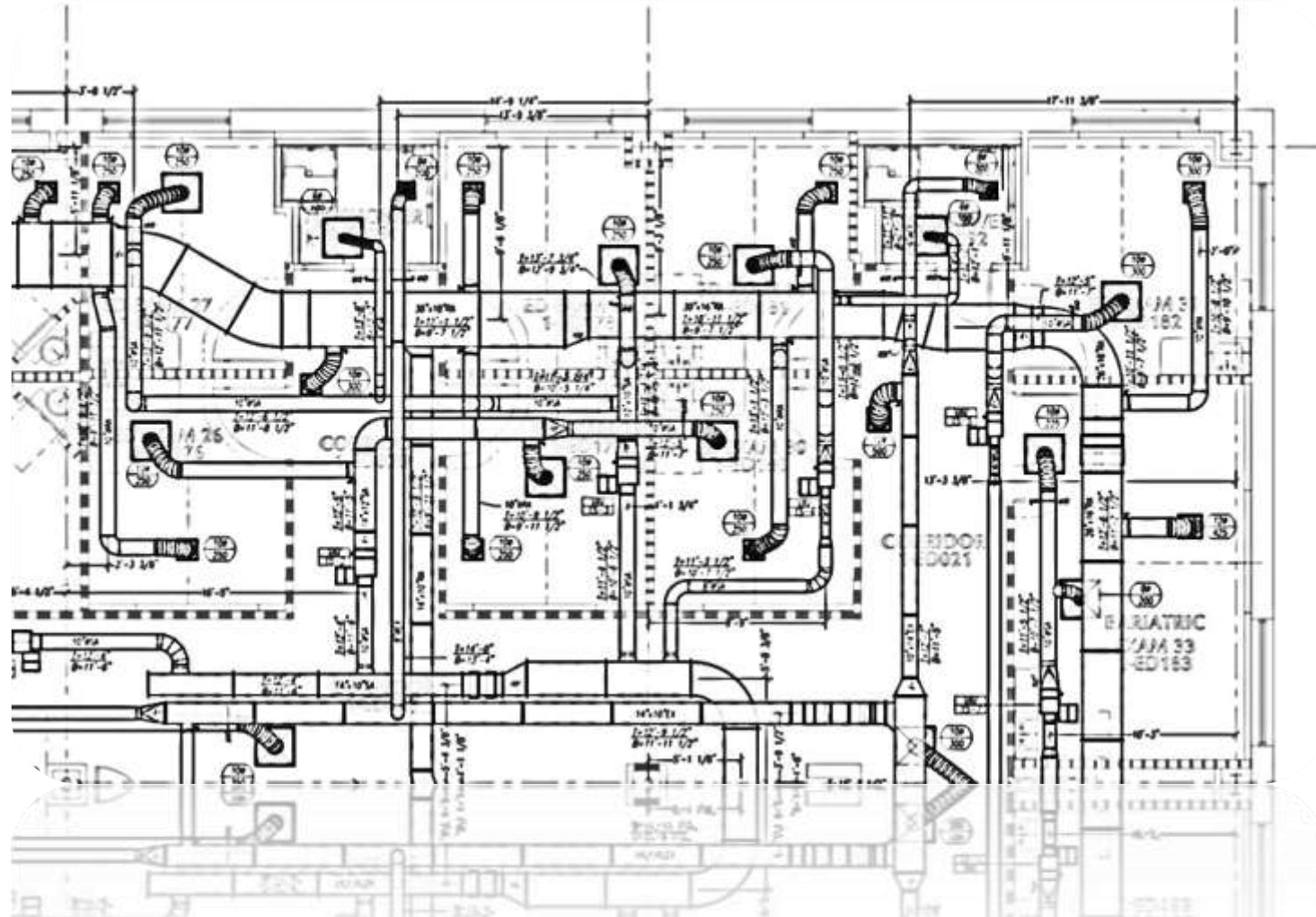


Extend total incubation time about 3-6 hours

# A SOLUTION SIMILAR TO MODERN SYSTEMS



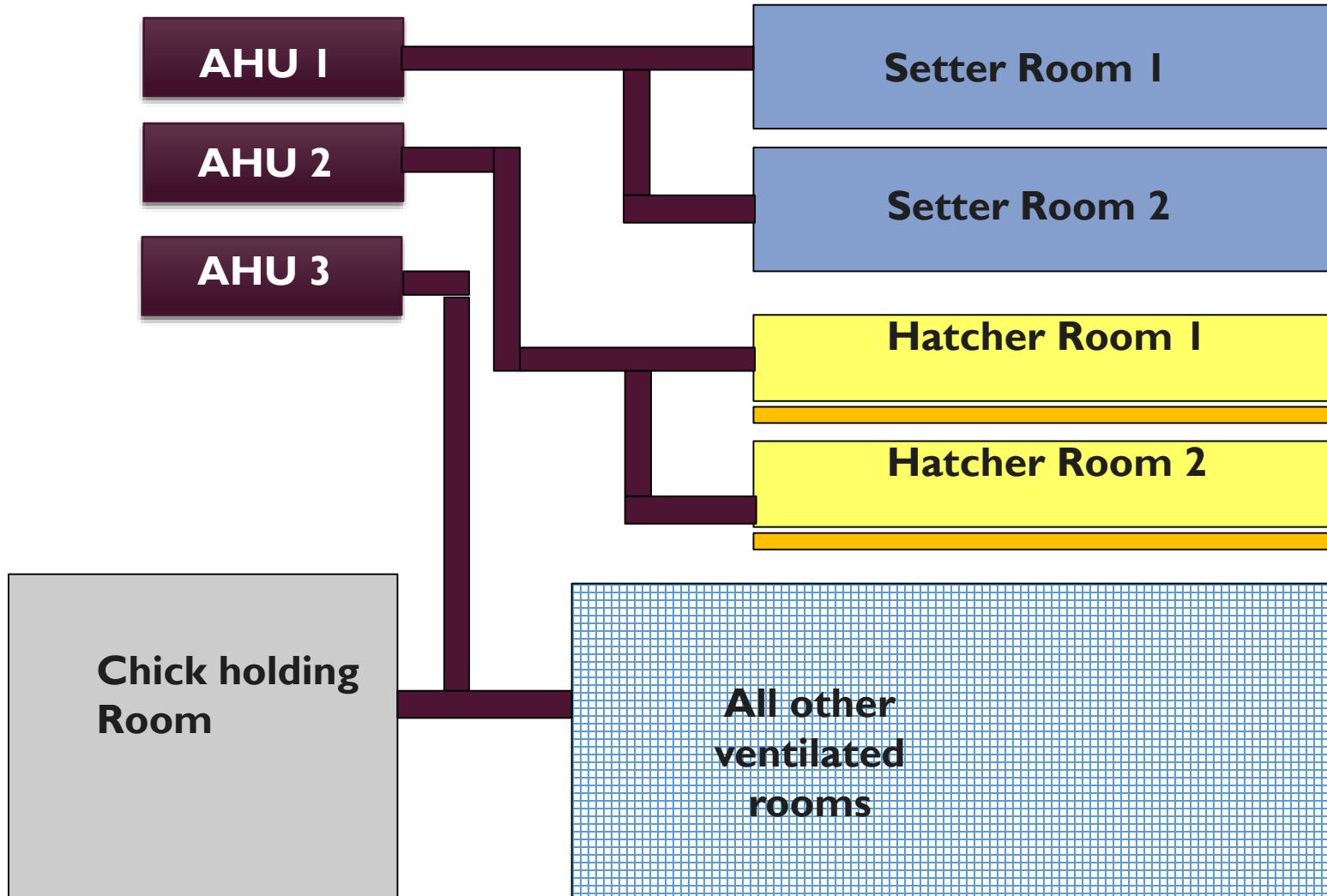
# HATCHERY VENTILATION



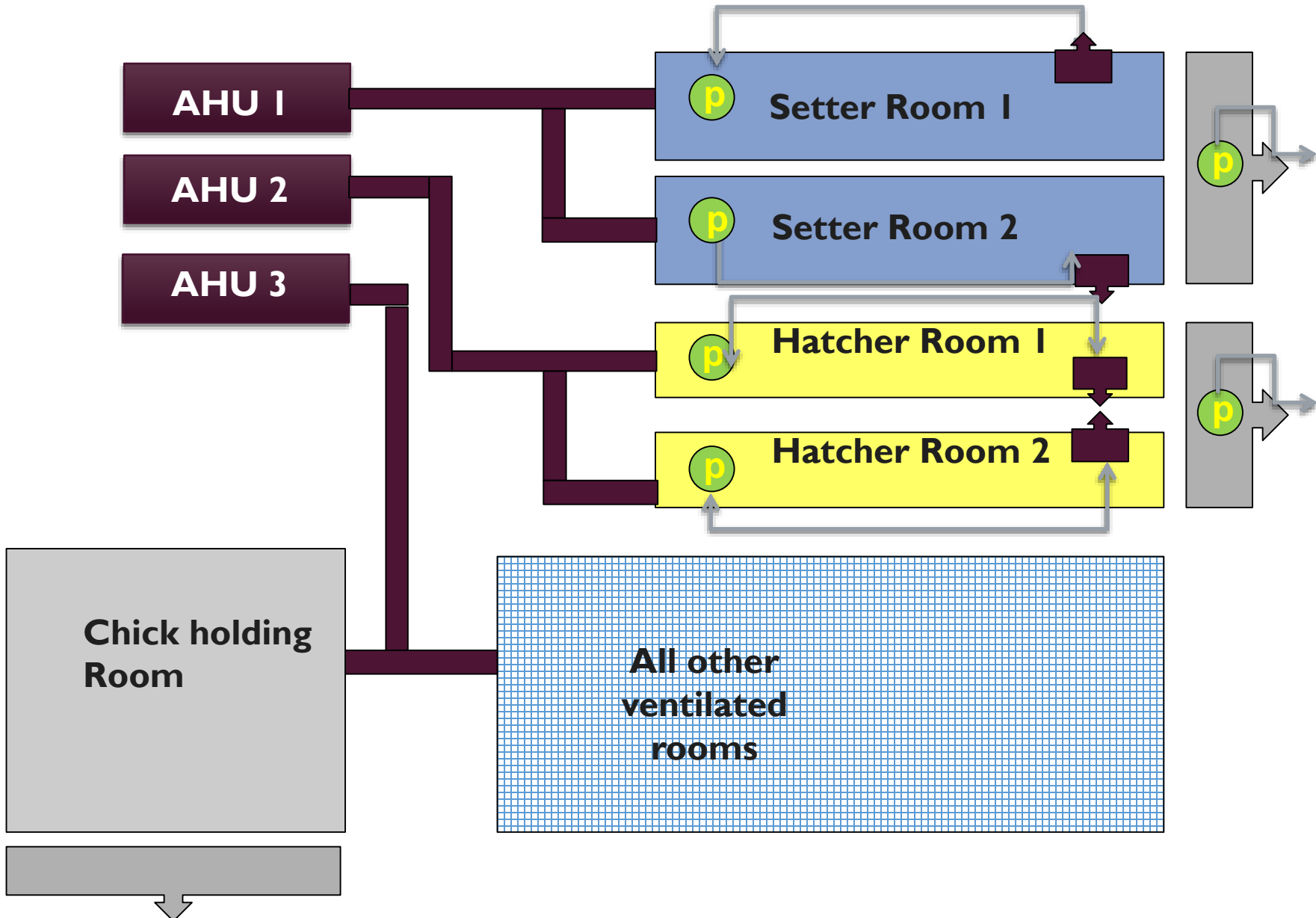
# VENTILATION SYSTEM TYPES

- Fixed volume system
  - No pressure control, no air volume control
  - Pressure controlled by variable bypass fans
- Variable volume systems
  - Controlling air volume with variable speed fans
  - Controlling air volume with dampers & variable speed exhaust fans
- Variable volume system with energy recovery
  - Air recovery
  - Water recovery

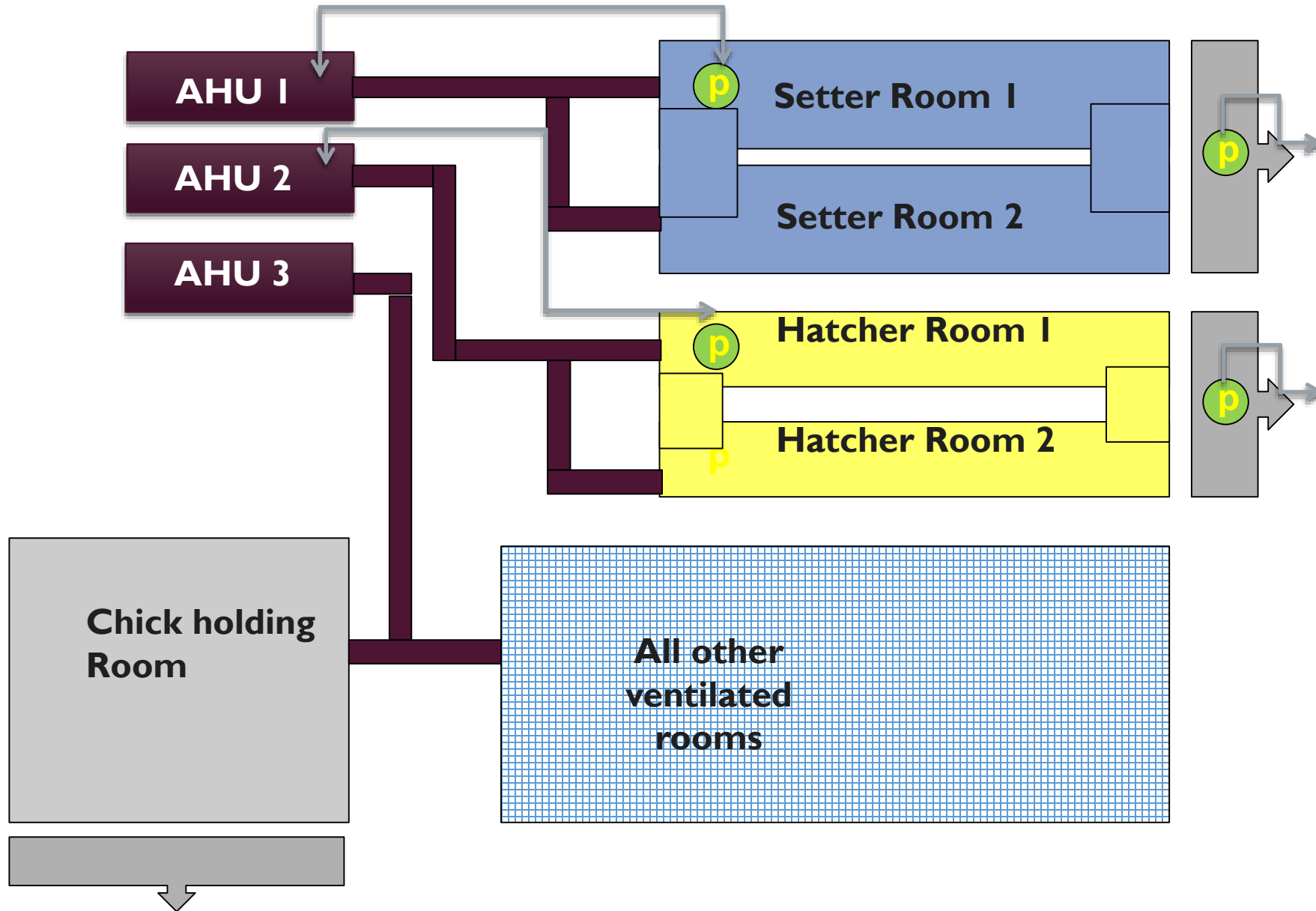
# FIXED VOLUME SYSTEM



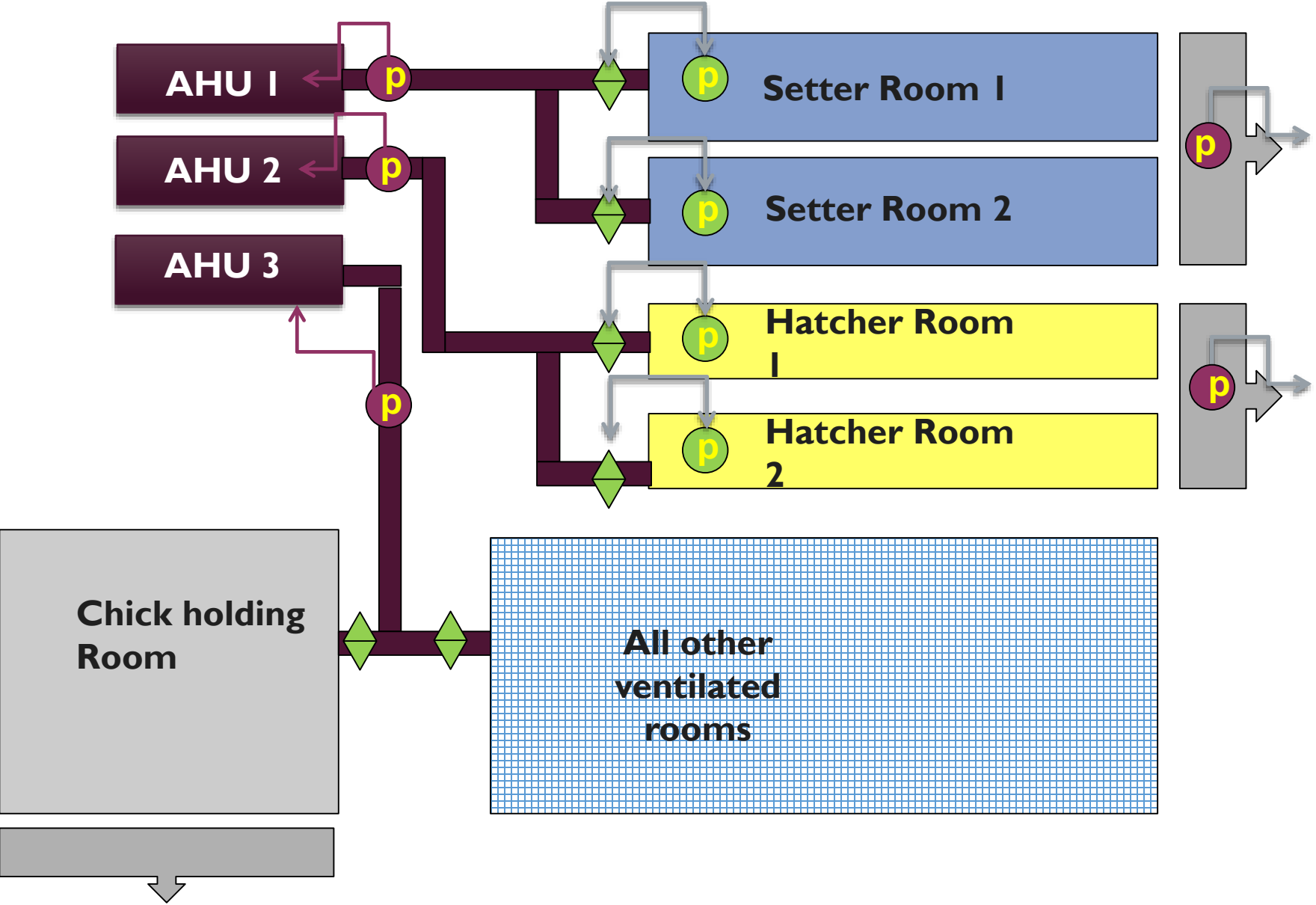
# FIXED VOLUME SYSTEM WITH PRESSURE CONTROL



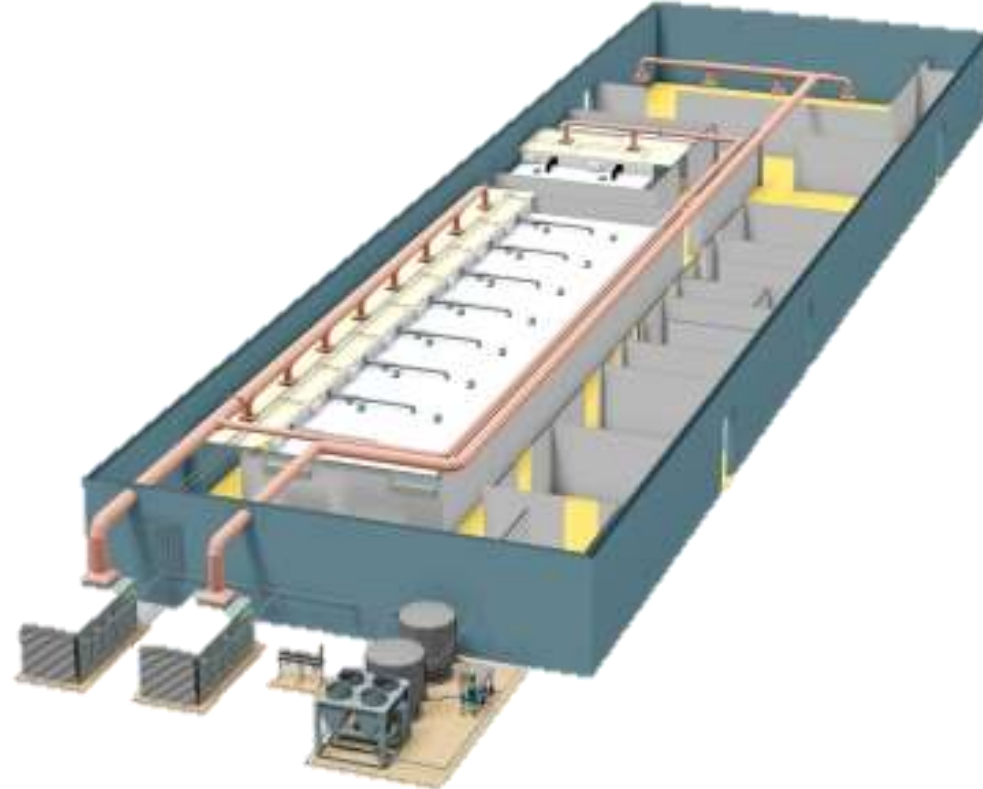
# VARIABLE VOLUME SYSTEM

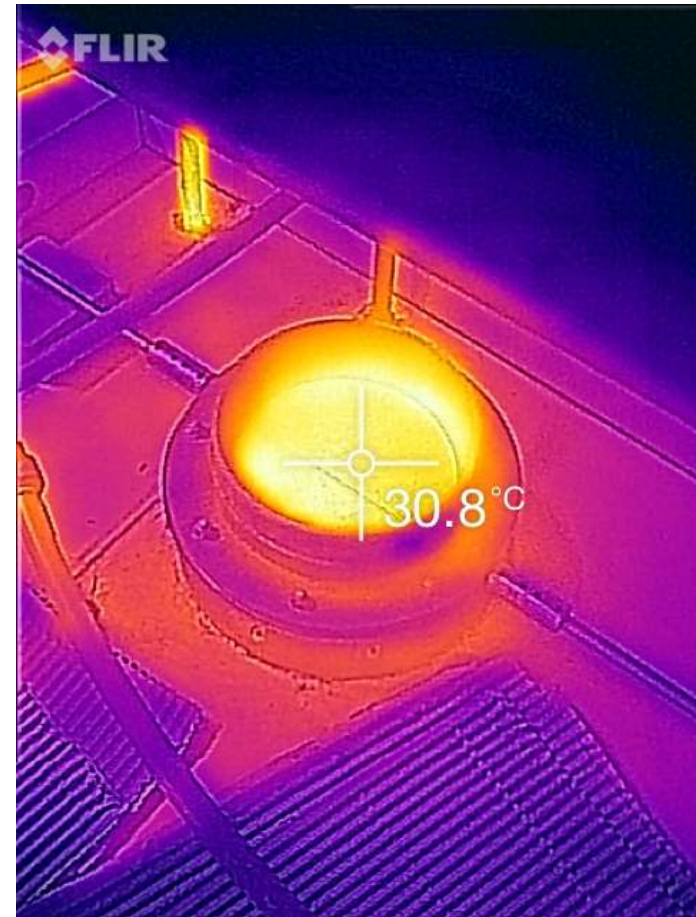


# VARIABLE VOLUME SYSTEM



LET'S TRY TO DO COMMENTS ON SOME REAL PHOTOS













# MAINTENANCE?







# DOOR SEALS



# PRESSURE FLUCTUATIONS



# UNDERSTANDING CV (COEFFICIENT OF VARIATION) IN BROILER CHICKS

## Content:

- **Definition:**

- CV measures weight uniformity (%) in a flock.
- Critical for early growth performance.
- Target CV for day old chick is <8

- **Formula:**

$$CV(\%) = \left( \frac{\text{Standard Deviation } (\sigma)}{\text{Mean Weight } (\mu)} \right) \times 100$$

# WHY CV MATTERS

## Why Low CV Matters

- ✓ **Uniform start:** Similar growth potential across the flock
- ✓ **Optimized feeding:** All chicks can access feed and water equally, easy feeder/drinker adjustment
- ✓ **Better welfare:** Less competition and stress
- ✓ **Efficient vaccination:** Similar response from all chicks
- ✓ **Predictable performance:** Easier to manage in the field

## Consequences of High CV

- ⚠ **Uneven feed & water access**
- ⚠ **Higher early mortality**
- ⚠ **Variable growth rates → multiple slaughter weights**
- ⚠ **Vaccination inefficiency**
- ⚠ **Processing plant rejects / downgrades**
- ⚠ **Lower feed conversion ratio (FCR)**
- ⚠ **Increased labor and management efforts**

# INTERPRETING CV RESULTS

- **CV Ranges:**
  - <8%: Ideal
  - 8–10%: Monitor
  - >10%: Take action
- **Key Factors:**
  - Set balance-Source flock age, egg age, fertility
  - Total incubation & holding time
  - Hatchery conditions: Temperature/humidity/time
  - Transportation conditions
- **Actions for High CV:**
  - Good planning of set
  - Avoid Dehydrated/Green chicks
  - Control Incubation/transport conditions



# CHICK TRANSPORTATION

STANDARDS, CHALLENGES AND SOLUTIONS



# CHICK QUALITY

We could produce good quality chicks.

However;

We have to keep this quality good until chicks will arrive to farm

So we need to do an efficient & proper chick transportation



# Important points

- Specifications of vehicle: Big impact on transport performance
- Environmental conditions: Transport can be a challenge
- Critical points: Chick quality, treatments, distance
- Brooding conditions: Preparations of farm

# Improving transport performance

- Chick quality
- Reliability
- Capacity
- Hygiene
- Dealing with weather conditions

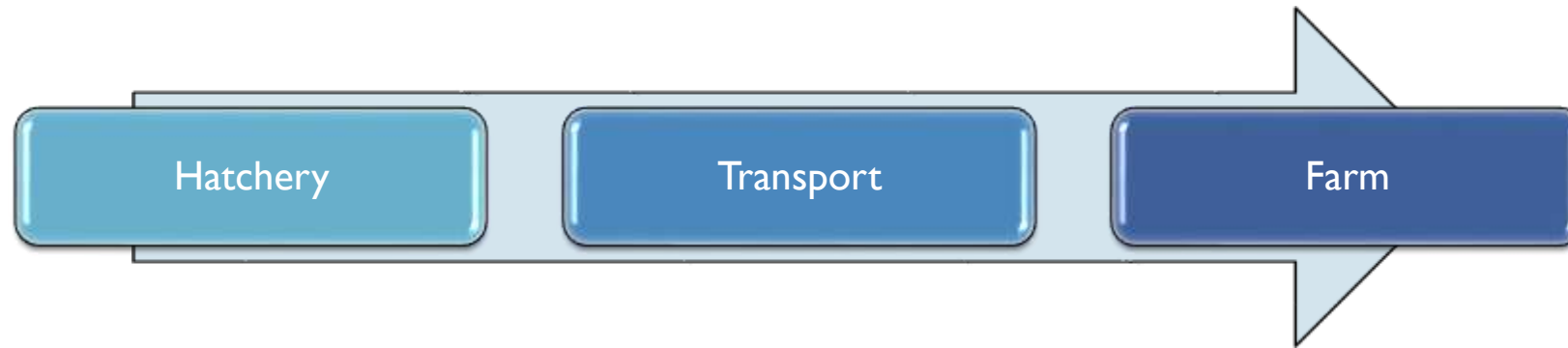
# What do day old chicks need

- Optimal temperature
  - Vent temperature 39.5-40.5 °C (103-105F)
  - Air temperature 25-28 °C
- Ventilation:
  - Recirculation for equal & even climate
  - Fresh air Ideal 0.1-0.2 (1000-2000 ppm), CO<sub>2</sub> maximum 0.5 % (5000ppm)
  - Air speed Slow or Fast
- Humidity 50-60%

# Loading

- Check all systems before loading : Use a check list
- Take chicks according to delivery plan: Distance/Timing
- Plan unloading: First in last out
- Secure chick trolleys: Road conditions/Sudden breaks
- Distribute boxes evenly: Use similar density
- Do not overload: Even for short distances
- Chose right ventilation method for climate (Fast/Slow)
- Monitor temperature/CO<sub>2</sub>/humidity during transportation

## Transport is a critical bridge in the process



- Hatcheries operate in a fully controlled indoor environment;
- Chick trucks operate in uncontrolled outdoor conditions;
- Transport effects farm performance.

# Challenges during transport

- Weather conditions: Temperature, humidity, rain, snow, ice
- Road conditions: Holes, curves, altitude, distance, customs, fuel, ferry
- Driver skills: Quality awareness, language problems, handling



# Impacts of Suboptimal-transportation

- Dead on arrival
- First week mortality
- Weight loss (dehydration)
- Digestive tract development
- Immunity
- Growth, feed conversion

28°



>40.5°(>105F)

28°



39,5-40.5°  
(103-105F)

25°



25°



<39.5°(<103F)

# Keypoints for climate control

- Ventilation capacity in recirculation and fresh air
- Even temperature distribution
- Sufficient cooling capacity
- Even distribution of air
- Utilization of air
- Air in- and outlet (location and size)

## ADAPTING SET POINTS IN PRACTISE

	28° C	
Full load	=	Half load
Summer	=	Winter
Plastic chick box	- 1° C	Cardboard chick box
Heavy d.o.c.	+1 ° C	Light d.o.c.
68 chicks per box	- 1° C	78 chicks per box

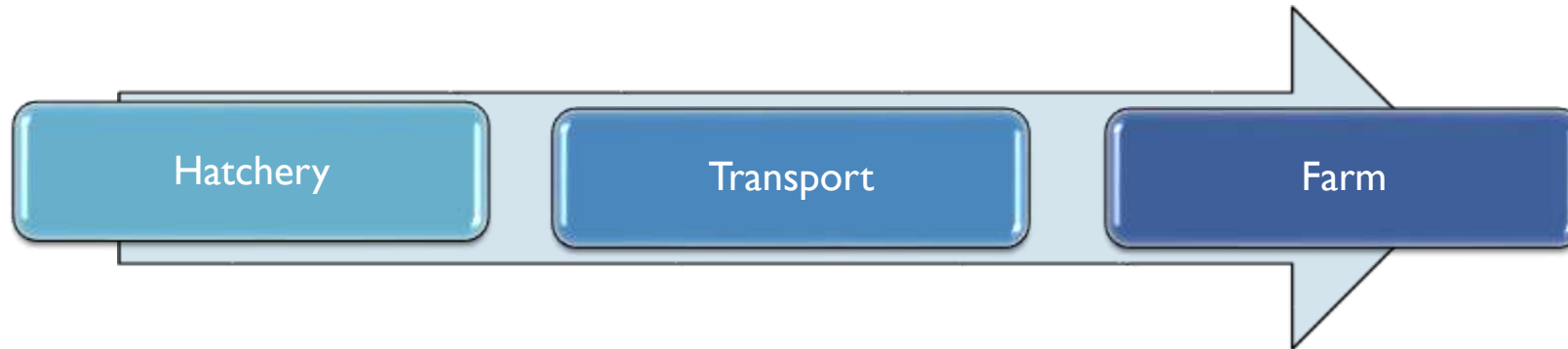
- Target 39.5-40.5°C (103-105F) vent temperature in the chick box

# Hygiene

- No discussion about importance
- Larger impact of poultry diseases
- Reduction in antibiotics use
- Chicken trucks and filters: easy to clean
- Disinfect, single load per transport
- Remove dirt, soak & foam, rinse, disinfect
- Apply fumigation at the end



## General tips in day old chick transport



- Check chick room in hatchery, inbox and body temperatures
- Load quickly, with loading dock or shelter
- Trolleys can help speed of (un-)loading
- Unload fast, short time between truck and farm house
- Keep hygienic rules
- Transport is finished when chicks have feed, water and comfort

## Key points

- Humidity is not the cause of dehydration, high temperature is
- Check chick room storage and unloading (handling, time) as important problem areas, 50% of DOA is probably caused there.
- Be sure about the house conditions and preparations

# KEY TO SUCCESS

- **Return to the basics:** Most effective way to investigate major issues. Focus on Eggshell Temperatures, Weight Loss and Chick Yield.
- **Don't assume:** Do not assume anything. Measure & observe by yourself.
- **Refresh your knowledge about your hatchery:** Cross-check your machine specifications and needs by using manufacturer advices; compare with yours
- **Investigate your eggs:** Identify the quality of your eggs, check dirtiness, fertility etc.
- **Re-consider your programs:** Ask yourself; Are you altering your programs according to the flock age, egg age and quality of your egg
- **Take actions:** Investigation is only a tool, take actions for better results



THANK YOU FOR LISTENING

Poultry Advisors  
*by Felga Erkus*



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