Brooding Principles-Importance

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Presentation outline

- 1. Brooding-what it is and why it is important?
- 2. Temperature-cold chicks and poor performance
- 3. Feed-early and as often and as uniform as possible
- 4. Water-The forgotten Nutrient
- 5. Environment what does the chicken need?

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The Goal of Brooding

- Accelerate Growth The First week of life
- Skeletal & Cardiovascular Development
- Stimulate Early Feed Intake
- Flock uniformity





- Without optimum performance during this period flock performance will be compromised and cannot be fixed later
- This is the most efficient period in the life of the bird-feed to weight gain (100% increase in weight in 1st 72 hours)
- Ensure Temperature Regulation Development 1st 5 days

Early vs. Final Performance Correlations-Final Weight vs. 7-day Mortality





Final Weight vs. 7 day mort %

> The lower the mortality the higher the weight

- Every 0.1% (above 1%) Mortality at 7 days is 10 grams less at slaughter
- Compromised chick start/quality results in lower final weight

Early vs. Final Performance Correlations

Final Weight vs. Seven day weight



Every 1 g at 7 days is worth 6 grams at 37 days

Seven day weight vs. final weight



- Data shows you can gain 90g in final weight by improving seven day weight from 160-180g !
- There is no gain in final weights to improve from 140-159g!

Cumulative Mortality vs. Seven day weight





- The houses with 177g + weight had farm mortality of 3.25%
- The houses with <160g weight had a farm mortality of 3.38%
- A small benefit (-0.13%) in mortality with 177g+ weights
- 61% of mortality from flocks with less than 160g seven day weight was from culling for "small chicks"
- Low seven day weights increase percentage of culling

Effect of seven day weight on Feed conversion



Very linear effect-higher seven day bodyweight = lower final feed conversion

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Seven day weight effect on Feed conversion



There is a dramatic improvement of 10 points in FCR if 7d weights increase from 160-180g

There is no real benefit on FCR with 7d weight increases below 160g (<140 -160g)

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Temperature



Specific body temperature for comfort and performance

Temperature too low

• Birds try to save or make heat:

Birds will huddle (don't move, don't eat: don't grow)

• Birds will burn feed to keep warm (higher FCR)

Temperature too high:

• Birds try to remove heat or avoid producing heat

• Birds will pant to loose heat (higher FCR)

Birds will stop eating (lower growth)

- > Also influence on bird health, immunity
 - Immune system and stress is costing energy
 - \odot Birds more sensitive for infections
 - \circ Less immune competent



First; Brooding (and incubation)

- Negative energy balance
 Birds need energy (heat) to keep warm
 Period of development (organs, skeleton, systems)
- Second; Growing
 - Positive energy balance
 - Birds produce more heat than required
 - Period of growth of tissues (muscles, fat)

Two different periods, two different sets of problems







Cold blooded to warm blooded



Transition period – chicks are sensitive to extremes in temperature out of the thermo neutral zone

Exotherm period: body temperature most important:controlled "from outside"during incubation: precise control, uniform.

But during brooding????

Temperature

- Chick internal temperature can be measured by using a Childs ear thermometer and placed gently inside the Cloaca
- Chick internal temperature should be maintained at 40°C 40.5°C.









- Chicks lose 3g of moisture from the feathers which act as a cooling mechanism when they hatch.
- Chick internal rectal temperature should be measured after the chicks dry and internal body temperature is stabilised.
- Chick internal temperature above 40.5°C will lead to panting.
- Chick internal temperature below 40°C is too cold.
- After four days of age the chick will now become thermo competent and internal temperature will increase to 41.5c

- Dehydration
- When the chick hatches the yolk contains 2g of moisture
- If the ambient temperature is 26c than the moisture in the yolk will last the chick three days Reference Hill
- If the ambient temperature is 40c than the moisture in the yolk will last the chick eight hours
- Van der Hel et al found that feed consumption was negatively affected at an ambient temperature of 36c





The most important temperature!

- Pre-heat for 48 hours-at least!
- Measure/recorded litter temperature!!
- USE Infrared temperature gun
- Correct litter temperature:

Furnace heaters: 30-32°C
 Brooders: 40.5°C (directly under brooders)

- Concrete should be pre-heated to a minimum temperature of 28c
- Litter temperature above 35c should be avoided because of feed intake reduction





Brooding-7 Day Mortality % vs Concrete Temperature @ Placement



➢7 day mortality increases to 1.31% from 0.96% when concrete temperature at placement is LESS THAN 28°C

Brooding-7 Day Weight vs Concrete Temperature @ Placement





➢7 day weight increases from 171g to 186g when concrete temperature at placement is GREATER THAN 28°C

Brooding-Final Weight vs. Concrete Temperature @ Placement



Final weight increases to 2,142 grams from 2,098 grams when concrete temperature at placement is GREATER THAN 28°C (44 grams)

Litter Temperature vs. Mortality %



Litter Temperature vs. Feed conversion



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Slaughter weight vs. feed consumption





- The higher feed intakes leads to higher final weights
- All efforts must be made to stimulate eating
- Remove all restrictions like long dark periods
- Give more light at night on hot days

Chicks should always be doing the following;

- Some eating
 Some drinking
 Some resting
 Some playing
- Evenly spread throughout the house
- ➤You should hear the birds before you open the door
- For the first two weeks the chicken house should be too warm for the farmer-if not than the temperature is likely too low for the chicks

Good management is reacting to the birds (the sensors)

Brooding





Brooding

- In the first twenty four hours after placement a chick needs to consume 20-25% of its own body weight in feed
- Also, In the first twenty four hours after placement a chick needs to consume 40-50% of its own body weight in water
- Don't fail to achieve this intake!
- Intake of feed and water are linked together
- Failure to achieve early intake results in reduced weight gain, higher mortality (because of increased culling for small nonstarter chicks) and poor flock uniformity





Early feed intake

Once the chick has eaten:

- Digestion starts
- Heat production starts
- Risk of being too cold is gone
- Temperature control begins

But if the chick has not eaten:

- No heat production
- Lower body temperature
- More cull chicks
- Thermo competence delayed





Feeding-How it works -What happens in our chicken?



Birds need carbohydrates (feed) so protein from the yolk will be available for development

Three day Old Broilers





Brooding





Yolk sac utilization



- Yolk contains immunoglobulins which are essential to protect the bird against pathogens during the first few days of life. (Dibner et al, 1998)
- Residual lipids in the yolk are essential components of cell membranes
- Amino acids and energy should come from feed. Yolk itself is not enough for optimum development.
- Feed consumption as early as possible to aid muscle development.



> Final meat yield is effected by early feed intake!

Feeding



The automatic feeding system should be placed on the concrete floor or down in the litter to make access to the feeding system as easy as possible for the chicks.

A line of paper should be placed at each side of each drinker line used in the house.

> The feeding system should be set on over flow/flooding for chick placement (if possible).



Feeding



Feed space using paper covering minimum 50% of the floor area.

➢Paper used should be news print type paper and not tissue paper to ensure adequate time for feeding before the paper breaks down.Paper good enough to last 5 days (47-55gsm/55-68% brightness-news print paper)

Supplementary trays one per 50 chicks

➢Feed amount on paper at placement (one application), minimum 50-75g per chick.



Closed housing - whole house brooding

Feeding

Additional feeding space for first week

100 watt blubs hung over demand pans at the end of the line for first 7-14 days

➢On each entry to the house during brooding the feed lines should be manually run to stimulate feed intake-at least four times daily for the first fourteen days









Paper cover 50% of floor area





Feeding on Paper



10 grams/chick



50 grams/chick



Every gram of food consumed in the first week is converted to 1.2g of weight

Percentage of paper on ADG



Gastro-intestinal Tract (GIT)



- This means they do not use Carbohydrates and Proteins very well
- The rapid growth in physical size and function of the intestines means that this is the best conversion rate in the birds life
- Intestinal growth starts 24 hours after ingesting begins
- Absorption area increases by increasing the size of the villi

Villi-600% increase in first seven days!



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Importance of water

- To form the cells and tissues. Muscles have 75%, Bone 40% and fat 20% water
- Carries nutrients and wastes dissolved in it
- It is needed as a median for all of the chemical changes in the cell
- Needed for digestion
- > Needed to cool the body by evaporation
- To prevent a rapid rise in temperature (it takes more heat to raise the temperature of water than any other substance)
- Needed to produce eggs which are about 66% water









Water consumption of 1 ml/bird per hour for the first twenty four hours after placement -minimum.



Maintain litter moisture between 25-35% under the drinking system, reduce pressure if litter becomes damp.

Place drinker lines at a height that the birds have to stretch slightly to reach-but feet always flat on the floor.

➢f water temperature exceeds 25c flush the system at horizontal three times /day.



Flow rate

Week 1 40ml/min

Week 2 50ml/min

Week 3 60ml/min

Week 4 70ml/min

Week 5 90ml/min

Cobb Water Flow Meter

How to use the Cobb Water Flow Meter

- Place under an active drinker line, where birds are drinking
- The gauze chimney should be placed touching the nipple so that the water flows freely
- Take the sample with a stopwatch for 30 seconds and record amount

Age

• After 30 seconds the amount required in relation to age is:

30 seconds
20 ml
25 ml
30 ml
35 ml
45 ml

Flow per

When floors have a slope, a slope regulator should be installed every 10cm of fall to allow even water flow down the line/house.

- Higher water pressure does not mean higher consumption
- Too low water pressure can reduce consumption by as much as 20%
- If the pressure is too low the bird needs more time to obtain its requirements, but the birds spend the same amount of time drinking whether the volume is high or low (under 1 minute)
- Reduced water intake = Reduced feed intake = Reduced weight gain

Theses are guidelines only and always litter moisture and water consumption should be checked before pressure adjustment



Water Temperature



- Beker and Teeter (1994) found the preferred water temperature of birds to be around 10C
- Water temperatures of 26.7C leads to significant reductions in water consumption and daily weight gain.
- > Water temperature above 25C should be avoided.
- The target temperature for vaccination is < 20C, if necessary this can be achieved through the addition of ice to the storage tank.



Flushing very important in hot weather (above 25c)-Minimum three times/day

The Bio-film management



- Poor line sanitation increases bio-film
- Bio-film lives on very few nutrients
- Harbors disease agents like E coli
- Once established it is 1,000 harder to remove-key keep lines clear
- ➤ Can return in 2-3 days after cleaning
- > After birds are gone, flush lines
 - Power flush is best, but any flush is good
 - 1 minute/30m length of line
 - Removes sediment, loosen bacteria, slime, etc
 - Hydrogen peroxide based- stabilized with silver nitrate
 - Filter-40-50 microns-cleaned weekly

Flushing-big deal?



- Trials- carried out in Germany (2014 by Big Dutchman)
- One farm-two houses
- One house flushing daily-other house no flushing
- Water samples taken at the end of the production cycle (40 days)
- The outlets were heated by a naked flame before sample was taken
- After ten seconds of drainage the samples were taken

into a sterile bottle







Flushing-results-Bacteria



Comparison of the average number of colony-forming units (CFU)



Flushing Farm results



House	Flushing	No flushing
Weight at slaughter-kg	2.729	2.671
Water/bird-litres-average	6.84	6.71
Feed/bird-kg/average	4.16	4.05
Feed conversion-2.7kg	1.51	1.53

Weight development during the fattening period



Water Line





Acids



- Acidifiers are not sanitizers
- Acidifiers need contact time and pH of 4 or less to damage or kill most bacteria
- During high water usage, contact time is minimal
- Can even get fungal blooms from low pH (thick slime)



(†) Benjamin Franklin. Scientist. Inventor. "Founding Father" (1706-1790)

Take home message: Use acidifiers as part of a sanitation program not in replace of it

Cleaning Drinker Lines



Left in lines standing for 24 hours



Line cleaned with acid-Citric acid



50% stabilized hydrogen peroxide (3 % solution tested)

CHICK CHECK-SAMPLE 100 chicks

➤ A minimum of 95% of the bird's crops should be filled upon examination the morning after placement.

➢ If the crops are checked eight hours after placement a minimum of 85% crop fill should be achieved containing both feed and water

Sample 100 chicks per brood area

> Evaluate crop fill and indicate results on form as below:

Crop fill	No. of chicks	Full - Pliable Feed & water	Full - Hard Only feed	Full - Soft Only water	Empty
Evaluation					

A Management Success Story:

European integrator:

- Results for 15 million broilers
 - Chick check = 73.3 %
 - slaughter weight = 2kg
 - CHANGED house set up for brooding
- Results for 15.5 million broilers
 - Increased chick check = 86.1% (+12.8%)
 - slaughter weight = 2 kg but 0.55 days earlier
- Saving of 0.022 points in feed conversion!

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Waste Products our ventilation system needs to manage

- 1) Moisture;
 - 100g chick at 30c produces 1.3g of water/bird/hour
 - 2kg bird at 18c produces 8.5g of water/bird/hour
 - So a house of 40,000 birds at 2kg live weight produces 8,000 litres of water/day

2) Carbon Dioxide;

- 100g chick produces 0.5g of Carbon Dioxide /bird/hour
- 2kg bird produces 5.4g of Carbon Dioxide/bird/hour
- So a house of 40,000 birds at 100g live weight produces 480kg of Carbon dioxide/day (not including possible production of CO2 from heating system)

Controlling Moisture

- The only way to reduce humidity is to heat the air (approx every 1c increase in temperature, %RH is reduced by 4.5%)
- As air heats it expands and its ability to hold moisture increases
- Hot air rises- the hottest air in the house is at the top near the ceiling
- Air should enter the house and mix with the hot air in the top of the house
- Operate the house at the correct pressure to achieve this aim

Controlling Moisture

- The best results from reducing air relative humidity is when there is a big difference between inside and outside temperature.
- Better reduction in relative humidity- winter time, during brooding and in cold climates.
- Less effective reduction in relative humidity-summer time, when the birds are older and in warm climates.

The Science behind the theory!

Example 1:

Outside air with a temperature of 5°C and 90% relative humidity contains 4.8 g of water per. In the event of a temperature rise up to 20°C, the relative humidity will drop down to 33%, while the water content remains the same per kg air. A further increase in temperature up to 33°C results in a further reduction of humidity, i. e. down to 15%, so that the house is dehumidified although with very humid cold air is introduced into the house from the outside

Or at 33c the air can now carry an extra 27.2g of moisture

• The water content of the air in g/kg air is temperature dependent

Levels of CO₂

- The level of Carbon dioxide in your atmosphere is +/-400 ppm.
- Under good temperature control but with insufficient ventilation, carbon dioxide levels can exceed 10,000 ppm!
- > You should never sacrifice temperature for ventilation.
- > You should never sacrifice ventilation for temperature.

Effects of High CO₂ Level

- ➢ Will reduce activity
- Reduced feed/water consumption
- Increased incidence of dehydration
- Lower weight gain
- Increased incidence of right ventricle failurelater in life (Ascites)

Ventilation-Air Quality

>There must be no drafts (either warm/cold) at floor level for the first fourteen days of age-a draft is an any air movement that exceeds 0.3m/sec at chick level.

Air quality guidelines			
Oxygen %	> 19.6%		
Carbon Dioxide (CO2)	< 0.3% / 3000ppm		
Carbon Monoxide	< 10ppm		
Ammonia	< 10ppm		
Inspirable Dust	< 3.4mg/m ²		
Relative Humidity	45 - 65 %		

Minimum ventilation must be increased if above levels are exceeded.

Minimum Ventilation

- Operates any time house temperature is at or below set point temperature
- Responsible for AIR QUALITY in the house
- And to provide the required oxygen for the birds
- Fans run on cycle timer (5 minute cycle)
- Minimum run time 60 seconds for air and heat distribution
- Calculate the volume of the house-width x length x average height

What is air exchange?

- Air exchange is the ability of the ventilation system to remove all the air from the house
- Minimum ventilation system should have the fan capacity that is able to remove all the air in the house in eight minutes-Timer and side wall inlets
- Transitional ventilation should be able to remove all the air in the house in less than two minutes-using thermostat and side wall inlets

Minimum Ventilation System

- Example; house 120 m long and 15 m wide with an average height of 2.5 m
- Fan capacity is 900 mm fans at 345 m3/min
- House capacity = 120 x 15 x 2.5 = 4,500 m3
- Required fan capacity = 4,500m3/8 min = 562.5 m3/min
- Required number of fans is 562.5/345 = 1.6 fans or two fans

Adjusting Minimum Ventilation

If unsatisfactory, only 1 way to correct:

- Increase air volume (reduce off time by the same amount that the on time is increased-total cycle stays the same)
- Increase cycle timer and/or add fan to timer
- Make small adjustments (10-30 sec / 5 min)
- Timer should be increased according to air quality (CO2 levels)
- Or timer on time can be increased by 0.5 minute per week and off time decreased by 0.5 minute/week

Good Air flow

Air "Dumping"

Air Inlet "cracked"

Negative Pressure Scale

House width-m	Pascal's	Air speed m/seconds	Distance travel before air drops-m
10	8	3.50	5.00
12	10	4.00	6.00
15	17	5.00	7.50
18	26	6.35	9.00
21	37	7.50	10.5
24	42	8.00	12.0

Calculations done at 1.2 kg per cubic meter of air density

