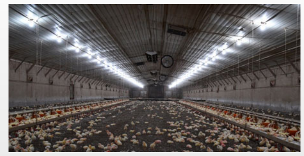
Using Ultrasonic Water Meters as a Management Tool

Michael Czarick
The University of Georgia

1

Probably the best measure of brooding conditions is…

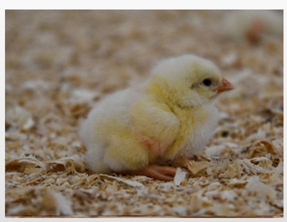



- Chick feed consumption
- Quite simply, the better a house is managed (environment, feeders, drinkers, etc.),
- the greater the amount of feed the chicks will consume,
- and the better the chicks will likely perform.

2

Knowing how much feed the chicks consumed on the first day…the first few hours…can be extremely beneficial

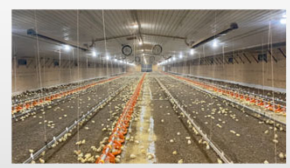
- You could very simply evaluate:
  - Different brooding temperatures
  - Paper under drinkers



3

Knowing how much feed the chicks consumed on the first day…the first few hours…could be extremely beneficial

- You could very simply evaluate:
  - Different brooding temperatures
  - Paper under drinkers
  - Mini feeders Vs. feeder paper



4

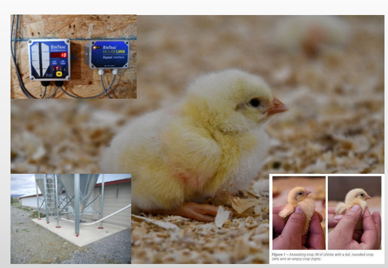
Knowing how much feed the chicks consumed on the first day…the first few hours…could be extremely beneficial

- You could very simply evaluate:
  - Different brooding temperatures
  - Paper under drinkers
  - Mini feeders Vs. feeder paper
  - Periodic drinker line flushing
  - Brooding lighting programs
  - Etc.

5

The challenge is how does one accurately measure feed consumption during brooding?

- Crop fill?
  - Labor intensive
  - One time measurement
  - Subjective
- Bin Scales?
  - Expensive
  - Does not produce accurate data for the first week or two of a flock



6

A far better way of measuring chick feed consumption is by measuring chick water consumption

- It is a well-established fact that broiler water consumption and feed consumption are very closely related.

7

During brooding they will drink a little more water for every kg of feed consumed…

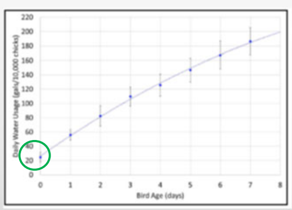
- roughly 2.5 kg of water or 2.5 liters of water
- But water still remains an excellent indicator of feed consumption

- So, if we can accurately measure water consumption on the first day of a chick's life, we can essentially measure its feed consumption.

8

How much water are the birds consuming on placement day?

- Daily water usage per 10,000 chicks (Days 0 – 8)



- 25 gals/day per 10,000 chicks (95 liters)

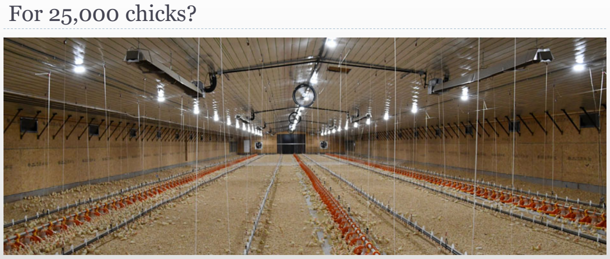
9

Flow rate per minute ?

- 25 gals/day per 10,000 chicks (95 liters/day)
- 1.04 gals/hour per 10,000 chick (4 liters/hour)
- 0.02 gals/min per 10,000 chicks (0.08 liters/min)

10

For 25,000 chicks?



- 2.5 X 0.02 gals/min = 0.05 gals/min (0.20 liters/min)

11

What does 0.05 gals/min (0.20 l/min) look like?

12

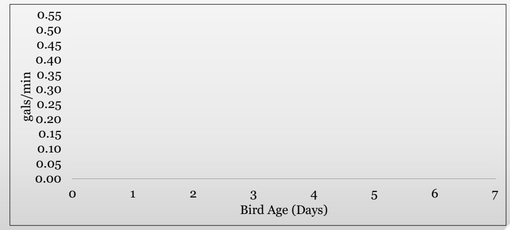
The problem is that the typical ¾” water meter doesn’t read accurately until the flow rate reaches approx. 0.25 gals/min.

- Average water flow rate for 25,000 birds
  - Day 0 = 0.05 gals/min
  - Day 1 = 0.10 gals/min
  - Day 2 = 0.14 gals/min
  - Day 3 = 0.20 gals/min
  - Day 4 = 0.23 gals/min
  - Day 5 = 0.26 gals/min
  - Day 6 = 0.30 gals/min
  - Day 7 = 0.33 gals/min

13

Since flow rates are not a constant ….

- Highly accurate water usage data may not be obtainable until the chicks are about a week old



14

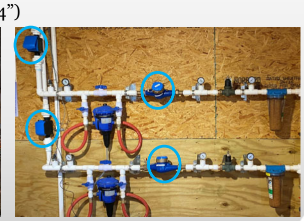
The good news is that ultrasonic water meters, such as the Sonata, can accurately measure much lower flow rates

- Dwyer Mechanical
  - 3/4” = 0.25 gals/min
- Sonata
  - 3/4” = 0.05 gals/min

15

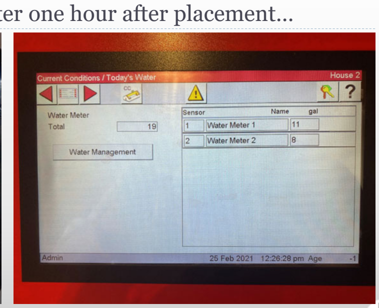
Placement day comparison:

- 54’ X 600’ Broiler house (full house brooding – 40,000 birds)
- Each half of the house has a mechanical water meter (1”)…
- and an ultrasonic water meter (3/4”)



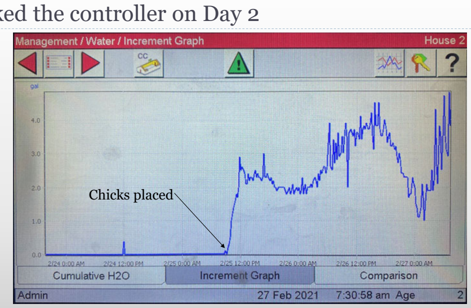
16

Checked the water meter one hour after placement…



17

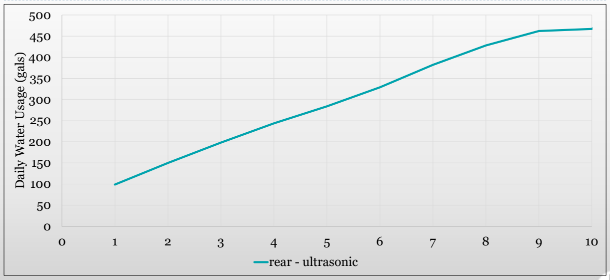
Checked the controller on Day 2



15-minute water usage

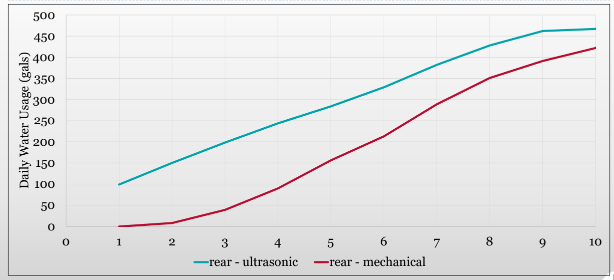
18

¾” Ultrasonic vs 1” mechanical (Day 0 – 10)



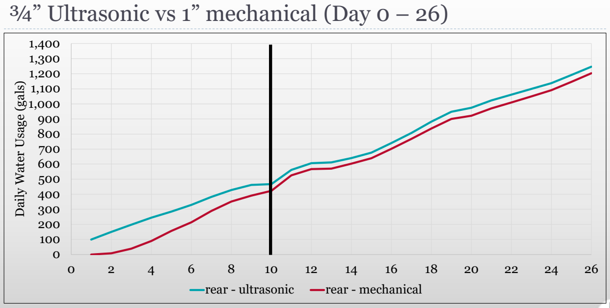
19

¾” Ultrasonic vs 1” mechanical (Day 0 – 10)



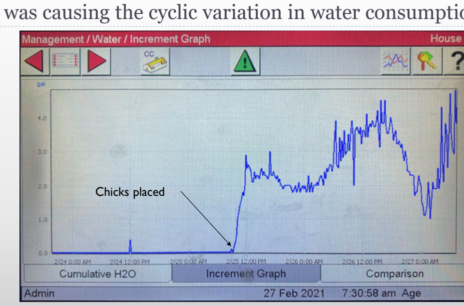
20

¾” Ultrasonic vs 1” mechanical (Day 0 – 26)



21

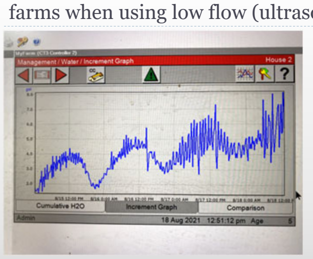
What was causing the cyclic variation in water consumption?

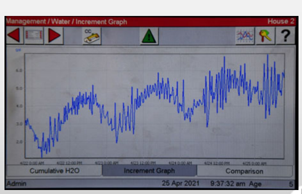


15-minute water usage

22

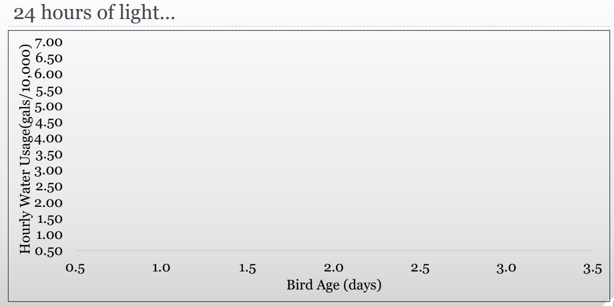
This same water consumption pattern has been seen on other farms when using low flow (ultrasonic) water meters





23

There is a circadian chick activity cycle even when they are given 24 hours of light…



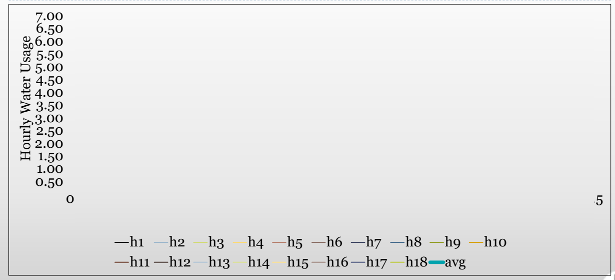
24

This phenomena was documented six years ago during a study related to placing paper under the drinker lines

- Installed a total of 18 low flow water meters on eight broiler farms

25

Chick water usage – 18 houses across eight farms



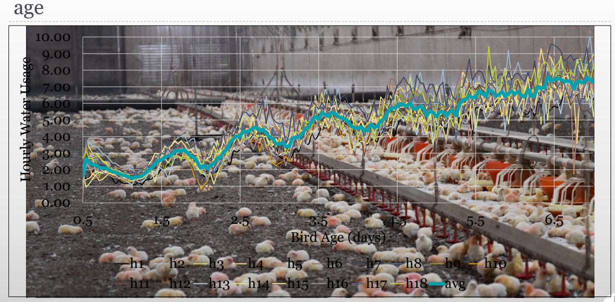
26

The fact is a circadian activity cycle is natural…

- It's seen in all animals….even microorganism
- It is essentially hardwired into all animal's brains

27

The circadian activity cycle tends to dissipate by around 5 days of age



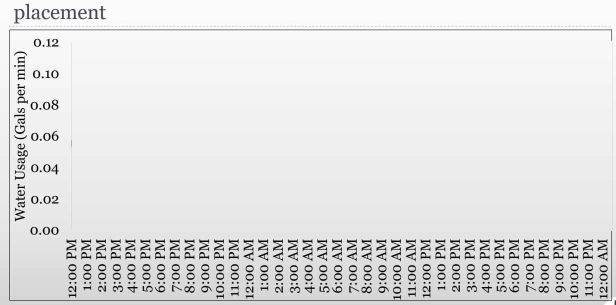
28

There is not only a long-term, circadian activity cycle…

- there is also short-term activity cycle

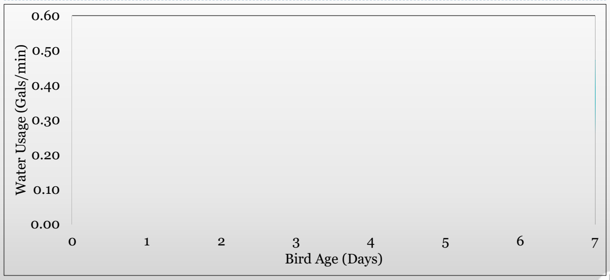
29

The short-term activity cycle develops roughly 12 hours after placement



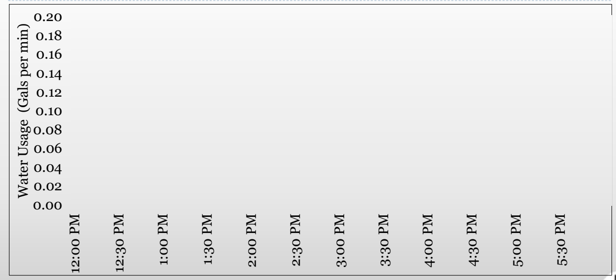
30

So, you end up with two activity cycles on top of one another

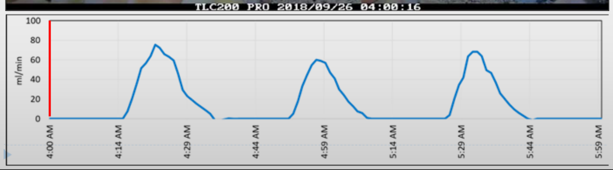


31

The short-term activity cycle is approximately 30 minutes in duration



32



33

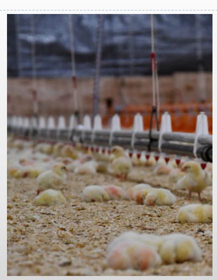
This data indicates that chicks spend about half of the time napping

- But is napping sleeping?

34

The fact is having a dark period, a true sleep period, is very important to birds

- Dark periods have been shown to:
  - Increase melatonin production:
    - Immune response
    - Reduction of oxidative stress (lengthen life of cells)
    - Digestion???
  - Improve bird performance
  - Improve uniformity



35

What defines a dark period?

- A minimum of 4 to 6 contiguous of darkness

36

If a circadian rhythm is natural…if sleeping is natural

- Why do we discourage chicks from sleeping the first week when they probably need it the most?

37

We have conducted numerous lab/field studies where we providing chicks with a dark period starting on day of placement

- Four and six hours of darkness using a dawn/dusk dimmer
- Monitoring 7, 14, and 21-day weights, feed conversion, mortality.
- Also measuring Melatonin, Corticosterone, Super oxide dismutase (SOD)
- Gait scores and Bone strength

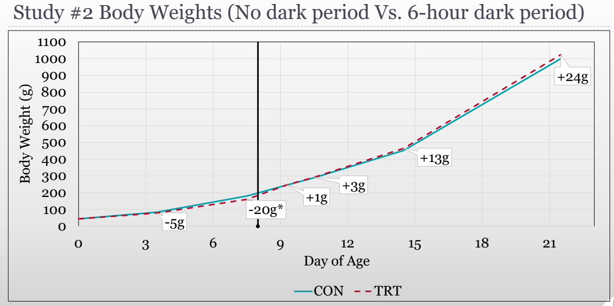
38

Study #1 (No dark period Vs. 4-Hour dark period)

Age	Variable	Treatment	
		24 Hours	20 Hours
0	Weight	43 g	43 g
3	Weight	**85 g**	82 g
	Feed conversion	0.7	0.72
7	Weight	**188 g**	182 g
	Feed conversion	0.84	0.84
10	Weight	299 g	**306 g**
	Feed conversion	0.99	0.98
14	Weight	528 g	537 g
	Feed conversion	1.08	1.09

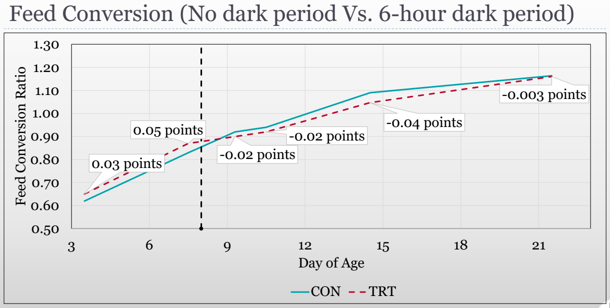
39

Study #2 Body Weights (No dark period Vs. 6-hour dark period)



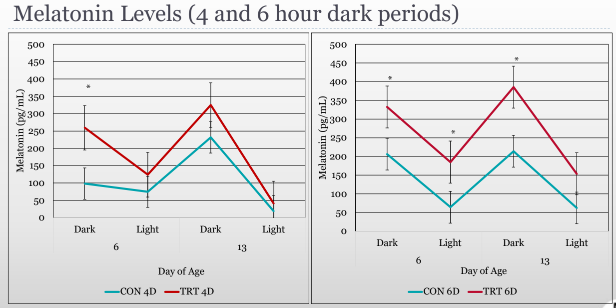
40

Feed Conversion (No dark period Vs. 6-hour dark period)



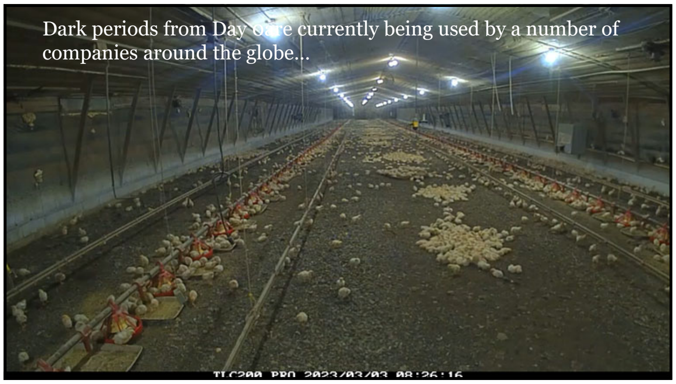
41

Melatonin Levels (4 and 6 hour dark periods)



* = p<0.05

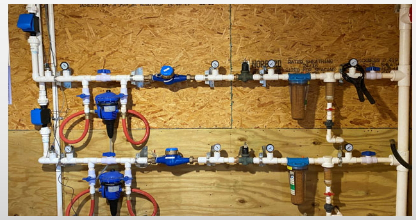
42



43

Sonata water meter – Beneficial features

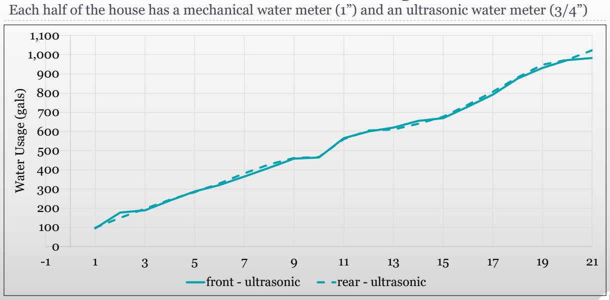
- Low flow accuracy
- Accuracy not dramatically affected by orientation



44

54’ X 600’ Broiler house (full house brooding – 40,000 birds)

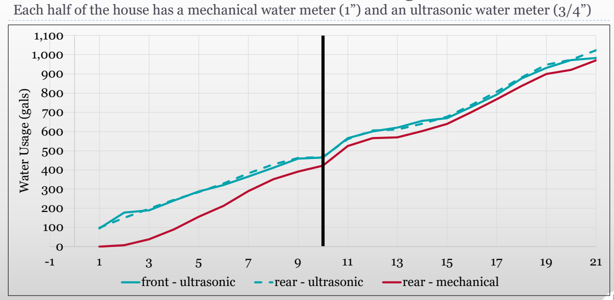
Each half of the house has a mechanical water meter (1”) and an ultrasonic water meter (3/4”)



45

54’ X 600’ Broiler house (full house brooding – 40,000 birds)

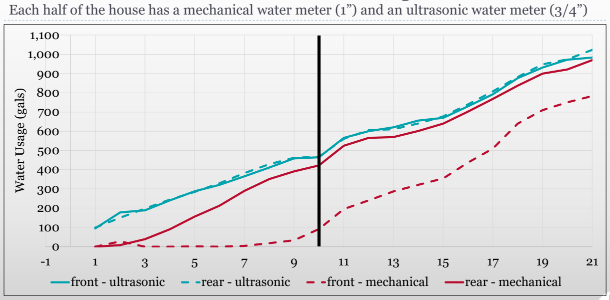
Each half of the house has a mechanical water meter (1”) and an ultrasonic water meter (3/4”)



46

54’ X 600’ Broiler house (full house brooding – 40,000 birds)

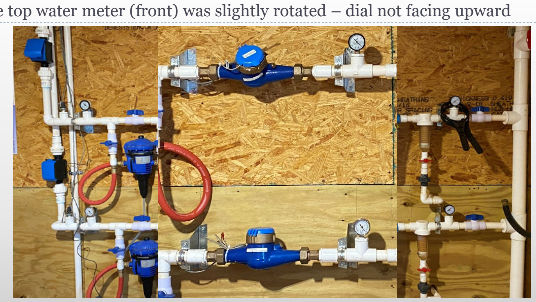
Each half of the house has a mechanical water meter (1”) and an ultrasonic water meter (3/4”)



47

Water meter installation issues

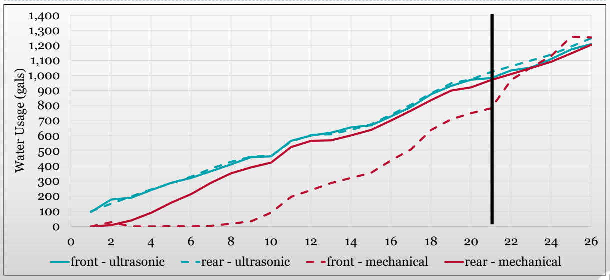
The top water meter (front) was slightly rotated – dial not facing upward



48

54' X 600' Broiler house (full house brooding – 40,000 birds)

Each half of the house has a mechanical water meter (1") and an ultrasonic water meter (3/4")



49

Sonata water meter – Beneficial features

- Low flow accuracy
- Orientation does not to accuracy
- Dual pulse output

50

Individual water meters for medicators and controllers could be replaced with a single water meter

- The fact is using a medicator the first week with a conventional mechanical water meter is dangerous

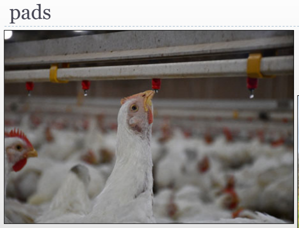
51

Sonata water meter – Beneficial features

- Low flow accuracy
- Orientation does not to accuracy
- Dual pulse output
- Flow rate display

52

Can accurately determine maximum water demand for birds and pads



53

Sonata water meter – Beneficial features

- Low flow accuracy
- Orientation does not to accuracy
- Dual pulse output
- Flow rate display
- No moving parts

54

Sonata water meter – Beneficial features

- Low flow accuracy
- Orientation does not to accuracy
- Dual pulse output
- Flow rate display
- No moving parts
- Less restrictive to flow


Pressure reduction caused by water meter at 5 gals/min

- Dwyer Mechanical
  - 3/4" = 1 psi
  - 1" = 0.48 psi
- Sonata
  - 3/4" = 0.15 psi

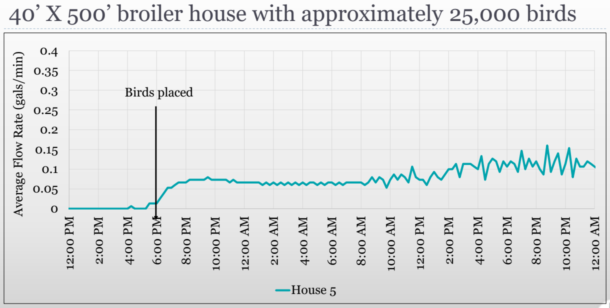

As meter size increases…you lose accuracy at low flow rates

- Dwyer Mechanical
  - 3/4" = 0.25 gals/min
  - 1" = 0.75 gals/min
- Sonata
  - 3/4" = 0.05 gals/min


Other uses of high accuracy water meters to improve house management?

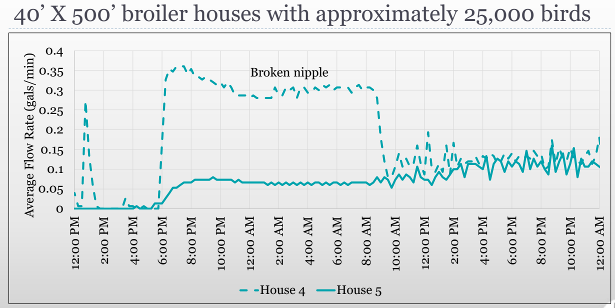
- Help determine excessive nipple leakage

40' X 500' broiler house with approximately 25,000 birds



15-minute readings

40' X 500' broiler houses with approximately 25,000 birds



15-minute readings