Ventilation Principles

Minimum Ventilation
Transitional Ventilation
Tunnel Ventilation

Martin, TN
November 6th, 2018
Chance Bryant – U.S. Technical Services
Goals of our Talk

1. Understanding why we need to keep improving ventilation
2. Understanding different ventilation practices, their principles and their duty
3. Common mistakes made in ventilation
1. Understanding why we need to keep improving ventilation
What is the one biggest reason we have to ventilate our houses?

- Carbon Monoxide?
- Carbon Dioxide?
- Ammonia?
- Oxygen?
- Yes, but also NO!!!! (All are very important)
Poultry House Minimum Ventilation

Biggest Reason ...........

• Humidity/Water removal!!!!!
• Birds consume a lot of water and a large % of this goes back into the house from the bird
• We have to remove this moisture
• Much easier for you in your environment!!!
Normal Broiler Water Use

• Only 20-30% of the water consumed by a broiler is retained
• The other 70-80% is put into the litter
• We know that birds drink ~twice what they eat
  • Every pound of feed eaten, drink 1 quart (2#) of water
  • For every 100 lbs consumed, drink 50 quarts water
  • 80% of 50 quarts is 40 qts
  • This means 10 gallons of water into the litter for every 100# of feed eaten
• 25,000 21-day, 2# broilers fed 3# have released 15,000 gallons into the litter! (a pool)
Normal Broiler Water Use
(24,000 Bird House)

Water Level – 75,000 Gallons per Flock
290,000 L
Water Consumption continues to increase!! Why???

Cumulative water consumption

- Cumulative water consumption (gals/1,000)
- Bird age (days)

Picture courtesy of Dr. Mike Czarick – University of Georgia
Cobb500™ improvements in SR broilers

Bird weight – 1.6kg and 2.7kg

<table>
<thead>
<tr>
<th>Age in Days to desired weight</th>
<th>1990</th>
<th>2000</th>
<th>2010</th>
<th>2020</th>
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</thead>
<tbody>
<tr>
<td>3.5lbs/1.6kg</td>
<td>42</td>
<td>37.5</td>
<td>33</td>
<td>28.5</td>
</tr>
<tr>
<td>6.0lbs/2.7kg</td>
<td>58</td>
<td>51</td>
<td>44</td>
<td>38</td>
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</table>

Potential of the future
## Percentage between 1st week & grow-out

<table>
<thead>
<tr>
<th>Year</th>
<th>1st wk as % of grow-out</th>
</tr>
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<tbody>
<tr>
<td>1990</td>
<td>16.7%</td>
</tr>
<tr>
<td>2000</td>
<td>18.7%</td>
</tr>
<tr>
<td>2010</td>
<td>21.2%</td>
</tr>
<tr>
<td>2020</td>
<td>24.6%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>1st wk as % of grow-out</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>11.9%</td>
</tr>
<tr>
<td>2000</td>
<td>13.7%</td>
</tr>
<tr>
<td>2010</td>
<td>16%</td>
</tr>
<tr>
<td>2020</td>
<td>18.5%</td>
</tr>
</tbody>
</table>

3.5lb 1.6kg

6.0 lb 2.7kg
Much higher demand on housing to capture genetic potential

Great change in “meat” development on carcass; not much in internal organ
Organs have to work much harder to maintain more meat/weight
Animal Welfare/Well-Being

• Today’s market environment requires us to “THINK LIKE THE CONSUMER”
• We can’t continue to do things as we did in the past
• The consumers “PERCEPTION” is as strong or stronger than reality!!!
• Keeping birds in an environment that is perceived as “ANIMAL FRIENDLY” is extremely important in today’s world
Today's houses need monitoring equipment to match it.
2. Understanding different ventilation practices, their principles and their duty
Three types of Ventilation Styles

• Minimum ventilation
  • Used for cooler weather and/or smaller birds
  • Trying to keep temperature from getting too cool and have good air quality

• Transitional ventilation
  • Used for “in-between” conditions
  • Trying to remove excess heat from the house

• Tunnel ventilation
  • Used for warmer weather and/or larger birds
  • Trying to remove excess heat from the Bird
Minimum Ventilation

• Inlets should be distributed evenly along entire length of house
• Static pressure should match house and weather conditions – wider/colder/wetter - higher SP; narrower/warmer/drier - lower SP (Typically)
• Smoke is best way to determine SP needs
• Allows air to come into house with enough volume and speed to mix with warm in-house air above the flock
• Incoming air doesn’t drop directly onto birds - No chilling
• Incoming cold air doesn’t drop on litter causing it to get wet
• Incoming air doesn’t drop directly on sensors
Ventilating chicks

- Chicks internal body temp is 40° - 40.3°C (104 – 104.5°F)
- Keeping chicks the ideal temperature is critical to your success
- Easy to run too much air (wind speed) on baby chicks
- Beware of drafts on chicks with no feathers
- Stir fans are needed but need to be ran correctly – don’t create drafts

Need to watch/observe birds and give them a comfortable environment no matter what time of day, of year or type of weather!!
Minimum Ventilation – Rules of Thumb (Guides)

1. For every .01”wc/2.5P of SP air is thrown ~2ft (61cm)
   • SP of .10”wc/25P should throw air ~20ft (6M)
   • This isn’t proven or scientific, but just a guide/starting point
   • Many things can affect this:
     • Inlets are open correctly
     • No obstructions to block air flow
     • Ceiling angle
     • Temperature and RH% of air
     • Inlet style
     • Etc. Etc.
Scientific research and more accurate

Courtesy of Dr. Hoff, Iowa St. University
Scientific research and more accurate

Picture courtesy of Dr. Mike Czarick – University of Georgia
Minimum Ventilation – Rules of Thumb (Guides)

2. For every 20°F (11.1°C) air increases in temperature the RH is cut in half

• Example:
  • 32°F (0°C) air with 80% RH
  • Air enters house correctly through inlets and increases in temperature to 52°F (11.1°C)
  • RH of this same air is now 40% RH
  • Same air increases to 72°F (22.2°C), RH is down to 20%
Controlling incoming air is a MUST in proper minimum ventilation
Minimum Ventilation – Rules of Thumb

3. Need approximately 15ft2/1.4m2 of inlet area per 10,000 CFM of fan capacity for minimum ventilation

• One 28,000cfm fan should need approximately 42ft2/3.9m2 of inlet to supply enough air
  • 28,000/10,000 = 2.8
  • 2.8 x 15 = 42

• Why is this important??????
  • Need to match inlet space to CFM capacity so inlets will opening properly with correct static pressure
Proper flow/direction incoming air during minimum ventilation - Good Air Administration
3 “Must Have’s” of Minimum Ventilation

1. Must have correct SP for your building
2. Must have correct Min Inlet door opening
3. Must then determine proper run time to control humidity in house
3 “Must Have’s” of Minimum Ventilation – 3 leg stool

Successful Minimum Ventilation

Correct Sp  Proper Time  Correct Vent Opening
Three Types of Ventilation Styles

• Minimum ventilation
  • Used for cooler weather and/or smaller birds
  • Trying to keep temperature from getting too cool and have good air quality

• Transitional ventilation
  • Used for “in-between” conditions
  • Trying to remove excess heat from the house

• Tunnel ventilation
  • Used for warmer weather and/or larger birds
  • Trying to remove excess heat from the birds
Goal is to avoid this with proper Transitional ventilation practices between minimum and tunnel

- Huge temperature variation from front to back going to tunnel too soon with slow wind speeds
- Creates multiple environments for our flock
- When migration fences are used we are growing birds in 4 different temperature ranges
transitional ventilation in action

keeps overall building temperature cooler which allows birds to remove heat easier into the air
Transitional Ventilation

• Often this can be the most difficult period:
  • birds can be chilled if tunneled too soon
  • Cool birds at inlet end/warm birds at fan end
  • in and out of tunnel often throughout the day
  • Increased temp variation from front to back

• We need to evaluate our equipment capabilities and manipulate our controller sometimes to help us through this period
Side wall inlets vs. ceiling mounted inlets

90° opening on wall inlet directs air much differently than ceiling mounted inlet. Affects the % of opening we should allow ceiling inlets to opening.
A lot of difference in air direction with a 90° opening on side wall vs. ceiling inlet.

Ceiling mounted inlets direct air directly on the birds when opened too much. This can cause wind chill on birds prematurely.
Transitional Ventilation –
Two Questions (Dos Preguntas)

1. How many fans can I run through perimeter inlets before going to tunnel?

• Most housing today are built to handle all min vent fans (if installed) plus at least ~35-40% of tunnel fan capacity
• Allows longer transitional period before moving to tunnel
• Helps assure once it goes to tunnel it stays
2. How far will my perimeter inlets open?

- Do they still direct air to the top of building where heat is?
- Can I direct air away from peak of house – cooling effect?
- Allows for more fan power through perimeter inlets
- Second SP should allow perimeter inlets to open more, increase volume of air, perform some cooling
- Use “Transition” setting on controller to help us manage Static Pressure
Ceiling mounted perimeter inlets need to be limited on how far they open to keep air from being directed down. This limits the amount of CFM’s that can be run through the inlets and causes us to move to Tunnel curtain and Tunnel Mode sooner.
Transitional Ventilation

• The use of “First and Second Static” on a Chore Tronics or “Static Pressure at Low Temp and Static Pressure at High Temp” on the Rotem
• These tools need to be understood properly and utilized to help us ventilate our houses better in these “in between” times that we refer to as “Transitional Ventilation”
• We should understand what is going on with this process
Understanding and properly using our Controllers can help us with Transitional Ventilation

Rotem Controller

<table>
<thead>
<tr>
<th>Static Pressure</th>
<th>Minimum Ventilation</th>
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<tbody>
<tr>
<td>S. Press. At Low Temperature</td>
<td>0.100</td>
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<tr>
<td>S. Press. At High Temperature</td>
<td>0.080</td>
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<tr>
<td>Low Static Pressure Alarm</td>
<td>0.001</td>
</tr>
<tr>
<td>High Static Pressure Alarm</td>
<td>0.250</td>
</tr>
<tr>
<td>Static Pressure Band</td>
<td>0.040</td>
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<table>
<thead>
<tr>
<th>Tunnel Ventilation</th>
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<tbody>
<tr>
<td>Target Static Pressure</td>
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<tr>
<td>Low Static Pressure Alarm</td>
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<tr>
<td>High Static Pressure Alarm</td>
</tr>
<tr>
<td>Static Pressure Band</td>
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</tbody>
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<tr>
<th>Attic</th>
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<tbody>
<tr>
<td>Target Static Pressure</td>
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Need an outside sensor for this setting to work properly!!
Understanding and properly using our Controllers can help us with Transitional Ventilation

Chore-Tronics controller

<table>
<thead>
<tr>
<th>Outputs and Temperatures</th>
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<tr>
<td><strong>On</strong></td>
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<tr>
<td>83.0</td>
</tr>
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<td>82.0</td>
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</tr>
<tr>
<td>72.0</td>
</tr>
<tr>
<td>71.0</td>
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</table>

**Static pressure**

- **Current Static Pressure**: .03
- **Current SP Limit**: High .06, Low .04
- **Power**
  - First: High .12, Low .10
  - Second: High .06, Low .04
- **Tunnel**: High Control Limit .06, Low Control Limit .04
- **Fixed Inlet Anticipation (sec)**: 30
- **Wind Delay (sec)**: 12

MT1642-028 10.04
Understanding and properly using our Controllers can help us with Transitional Ventilation.

Air flow moves from being directed toward the warm air in peak of house during minimum ventilation to being directed under this warm air and more toward the floor/birds.
3. Common mistakes made in ventilation

READY FOR THE
NEXT 100 YEARS
“IF EVERYONE IS THINKING ALIKE, THEN SOMEBODY ISN’T THINKING.”

- GENERAL GEORGE S. PATTON (1885-1945)
Biggest mistake is having houses that aren’t tight!!!

# 1 focus for proper ventilation is a tight house!!

A Loose House:

• Allows air to come in where we don’t want
• We have no control over our air entrance
• We pre-heat air if it doesn’t come through the inlet properly and go to peak of house
• We can’t remove humidity properly from our houses
• We chill our birds
• Can’t control heat build up in daytime
Poor air administration!!!
Use smoke emitters to test for air leaks during fan run times.
Poor air administration!!!
Results due to a loose house

-WARM AIR IN PEAK-

No Smoke/cool air not moving to warm air in peak

Smoke/cool air dropping on chicks
How to perform a pressure test

- Close all doors, curtains, perimeter inlets, tunnel inlets as tight as possible
- Seal up all holes that are visible
- Turn on fan that is equal to one CFM per square feet of floor space

Example:
- 40’ x 600’ (12m x 183m) house = 24,000 ft² (2196m²)
- Use one 54” fan rated at 25,000 CFM to run pressure test

Static Pressure should be:
- .20 to .25 for good houses
- .15 to .20 for medium houses
- .10 to .15 for ok houses
- Below .10 is not good
Pressure Test

One very loose and one very tight
Tightening of houses still most important thing we can do
False need of ventilation due to no “SMELL”

• When we clean houses out every time and have fresh bedding often this gives us a false sense of security in air quality
• In the U.S. we use litter amendments on built up litter – mask the ammonia – another false sense of security in air quality
• NO Ammonia = no need to ventilate (CORRECT???)
• We let humidity and moisture build up – wet/caked litter occurs
• We let CO2 build up – lethargic/non-active chicks which don’t perform well
• Birds need fresh air regardless of smell in the chicken house!!!
Results of improper ventilation rates – day after day

Moisture is building up

Picture courtesy of Dr. Mike Czarick – University of Georgia
You will not win this battle....... It will be there to fight the next flock again.
You will not win this battle……
It will be there to fight the next flock again
Carbon dioxide

- Carbon dioxide too high
- Chicks sitting – appear cold
- Creates lethargic chicks that do not eat/drink as they should
If we get one wrong – all can collapse

Correct SP
Vent Opening
Proper Time
Minimum ventilation inlet door not opening enough; Static Pressure is correct – still poor results

Air flow moves from being directed up the ceiling into the warm air to bouncing off the ceiling and more toward the floor/birds. This causes wet litter and cold floors/birds.
Most common reason for poor air administration – improper inlet opening

- Best to allow controller to operate inlets by Static Pressure
- Dangerous to use “% opening” to open and close inlets
- If we force the inlets to open by % opening typically we do not have proper Static Pressure
- When we don’t have proper Static Pressure our air drops too soon, chills chicks and can wet floors
Static Pressure/Velocity is too low; inlet door is open enough – still poor results

Air flow/velocity is too slow; air does not make it to the warm air in peak of house during minimum ventilation; falls too soon before being properly warmed.
Obstacles blocking the path of air flow

Air flow/velocity is correct; air is heading to the warm air in peak of house during minimum ventilation; falls too soon due to something blocking the path. Causes wet litter; cool floors/birds
House factors can affect air direction and overall ventilation

Air is not traveling the ceiling and mixing properly

Cold air falls too soon, drafting chicks and creating wet litter
Tunnel Ventilation: Replacing fan belts

- Belts should be even with the top of the pulley. Belts that are worn will slip down the pulley and have lower CFM’s. Up to 30%
- Belts should be replaced once every year.
- A Simple and quick evaluation can save you thousands
Not utilizing stir fans correctly
 Doesn’t matter what climate you are in or style of house you have – understanding ventilation principles is always important and applicable.
READY FOR THE NEXT 100 YEARS

Appreciate your attention
Thank You Very Much