Moisture and ammonia removal from chicken houses

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According to the USDA, 42.8 million pounds of broilers and turkeys and 6,735 million dozens of eggs are forecasted to be produced in the United States in 2013. The poultry industry in the United States is the largest producer in the world, and the second largest exporter of poultry meat, and a significant egg producer.

These sizeable poultry projections make it more crucial than ever for growers and producers to develop and maintain optimal environments for exceptional poultry growth and production. To be profitable, farmers must use the best practices and technological advances in order to achieve the most advantageous overall environment.

Body size, carcase composition yields and meat quality in domestic fowl have dramatically increased through the successful application of modern poultry genetics.

For example, at six weeks of age, a broiler chicken today weighs six times more than a breed genetically static since 1957, with 9% more breast meat.

Today's larger broilers have much larger breasts and, as a result, have become more reactive to temperature changes, dampness, ammonia and dust. There is a direct correlation between environmental conditions (like temperature, moisture levels, draughts and air quality) and poultry growth and performance.

Growers who cannot effectively control all of these factors have broiler birds with reduced health, lower live weight, less efficient feed conversion, poorer carcase quality and carcase yield.

Minimum ventilation

Cool weather ventilation demands different strategies and systems than during summer (hot weather) ventilation.

Ventilation in the summer cools the poultry house. But, in the cool months, 'minimum ventilation' helps manage the environment for moisture and ammonia removal.

Minimum ventilation works in concert with proper insulation, inlets and fan timing to keep the environment in the chicken house as constant and evenly conditioned as possible.

For every pound of feed a chicken consumes, it will consume nearly two pounds of water. In a broiler house with 25,000 birds, 25,000 gallons of water will have been consumed by day 28!

Because of genetics and faster growth rates, this number increases yearly – just 10 years ago, 25,000 birds would have consumed only 20,000 gallons by day 28.

Minimum ventilation has a bigger job to do than ever, and current ventilation systems are often not effective in the cool seasons.

Of the water consumed, approximately 75% ends up in the litter or in the air. It is the ventilation system's job to remove this moisture efficiently in order to prevent ammonia problems, foot problems, leg issues and condensation.

Unfortunately, it is not enough to simply turn on a fan or put it on a timer. It is critical that fresh air be 'conditioned' before being introduced to the birds and distributed evenly to prevent temperature stratification and dead spots.

Current solutions

How are current minimum ventilation systems designed? One of the most common systems uses exhaust fans run on timers that vary the cycle time based on bird age (for broilers or pullets) and bird numbers (broilers, layers, pullets, breeders, etc).

Sidewall or ceiling inlets are opened when the fans run to allow fresh outside air to be metered into the building. Fans are generally run at a high static pressure during minimum ventilation to create a high air speed at the inlet.

This high air speed is necessary to promote mixing of the cooler outside air with the warmer inside air before being introduced to the birds (conditioning). Without the high static pressure, the heavier cold air from sidewall inlets would simply fall to the floor, onto the birds without first mixing with warmer air in the house.

This cold air draught results in a poor bird environment, and ultimately, lost profits. Problems with the current minimum ventilation solutions include:

- Air speeds decrease very quickly beyond the inlet and in today's wider houses, fresh air may not make it to the centre of the

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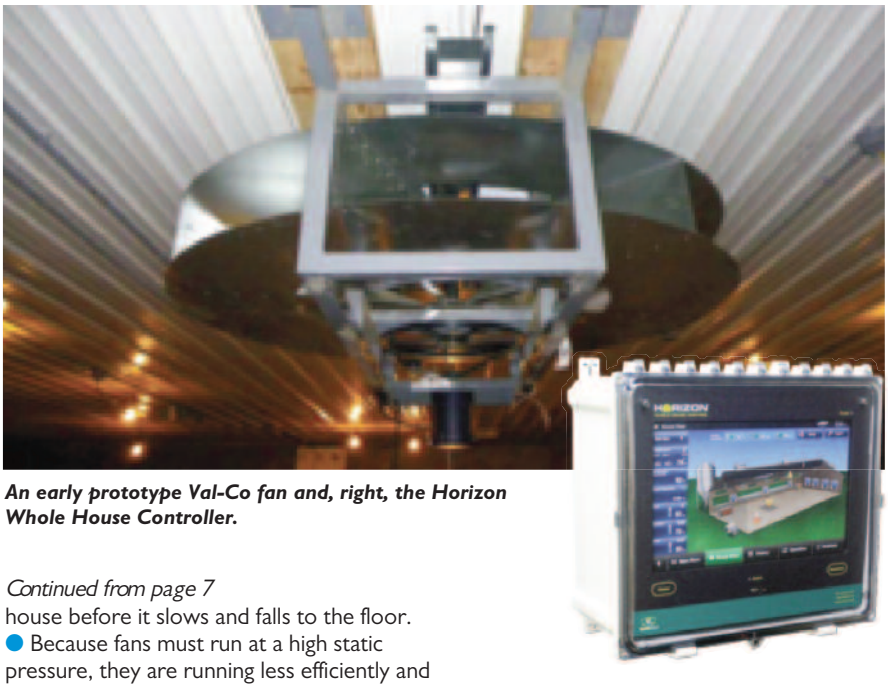
Table 1. Broiler body weight and FCR of 1957 diet versus 2001 diet.

	Body weight (g/bird)	Feed conversion ratio
2001 strain: 2001 diet		
21 days	791	1.31
42 days	2903	1.58
56 days	4402	1.94
1957 strain: 1957 diet		
21 days	184	1.73
42 days	591	2.28
56 days	921	2.37



An early prototype Val-Co fan and, right, the Horizon Whole House Controller.

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house before it slows and falls to the floor.

- Because fans must run at a high static pressure, they are running less efficiently and consuming more electricity per CFM of air exhausted.
- Supplemental heat, when needed, is added at discreet locations so there is a strong tendency to develop warmer areas and colder areas within the house.
- Temperature stratification occurs naturally because warm air is lighter and rises to the ceiling – it is not uncommon for the temperature to change 1-3° per foot!
- Because the fans cycle on and off, the fresh air from inlets also cycles on and off. This means that air distribution and mixing is not happening constantly – instead, there can be long periods of time with no air movement.
- Limited air movement means that wet litter may occur, leading to high ammonia levels and reduced growth efficiency.
- As a result of poor mixing of cool outside air with inside air, condensation can form on walls, fans, curtains and other surfaces, posing further risks and deterioration to structures and equipment.

System performance

The ideal cool season ventilation system would introduce fresh air into the house, and remove moisture and ammonia.

The ideal cool season ventilation system would accomplish the following:

- Condition cool, fresh outside air by mixing it completely with warm inside air before being introduced to the birds.
- Evenly and gently distribute the conditioned air throughout the house without draughts that harm bird development and health.
- Evenly distribute conditioned air effectively in today's wide houses.
- Eliminate cold areas and warm areas during cool seasons.
- Distribute supplemental heat evenly throughout the entire house.
- Gently vertically mix the house air to eliminate nearly all temperature stratification.
- Conserve electricity and lower operating costs by enabling exhaust fans to run more efficiently at a lower static pressure.
- Ensure consistent and gentle air movement at all times, rather than a cycle of rapid air movement followed by periods of dead air.
- Provide a consistent and comfortable environment for the birds through consistent air movement.
- Keep litter dry, reducing ammonia levels, through consistent air movement to improve feet quality.
- Minimise the opportunity for condensation to occur through consistent air mixing and movement.

The ideal design

A new system for cool season ventilation has been designed by Val-Co using a centrifugal fan with an optional metered ceiling inlet.

The system, known as the Val-Co Hemisphere Mixing Fan, features a large diameter (48" or 72") rotor with radial paddles housed in a steel frame and mounted to the ceiling of poultry houses. Like all centrifugal fans, it draws air from the centre of the rotor and propels it outwards. This action draws air from below to provide vertical mixing and distributes the air throughout the house.

When combined with the optional metered ceiling inlet, the fresh, cool outside air is simultaneously drawn from above and mixed with the warm air near the ceiling before being introduced to the birds.

Because the Hemisphere Fan is a large diameter centrifugal fan, it moves a large volume of air at a slow speed. This prevents draughts while mixing air in all directions. Cold and warm areas are eliminated. Users report less than two degrees of temperature difference top-to-bottom, end-to-end throughout the entire house!

The gentle air movement created extends up to 75ft in all directions. Recommended spacing is 75-125ft in a single row down the middle of the house.

When used with the optional metered ceiling intake, there is no need for exhaust fans to run at high static pressure, as the Hemisphere Fan is consistently mixing house air without the need for high velocities at the inlets. Lower static pressure means higher efficiency of operation.

When exhaust fans shut off, the Hemisphere Fan continues to run, providing consistent and gentle air movement. This results in a consistent and comfortable environment for the birds, drier litter, lower ammonia, and less condensation.

Conclusion

Today's poultry farmers must adapt to the ever increasing demands on quality, production, genetic improvements, and fuel expenses in order to make a profit. Farmers must continually seek advances in technology and techniques to improve their animal housing systems in order to remain competitive and be successful.

The innovative design of the Val-Co Hemisphere Fan for cold season ventilation is a smart product that helps farmers to control their chicken house environments for maximum stability and bird comfort. It dramatically reduces temperature variations and improves bird comfort, which ultimately leads to higher profits. Users are seeing two degrees or less in temperature variations throughout pullet and layer houses.

A Pennsylvania farmer selected Val-Co Hemisphere Fans in order to keep the temperature in his barn more even by destratifying the air during the cold months. His primary goal was to dry his litter more thoroughly in the cool season, so that he could collect drier manure and significantly reduce ammonia levels.

He reported being surprised at the uniform air temperature in his chicken house, how even the litter dried and noticed the temperature change throughout the barn on cold mornings was far less.

Poultry growers now have the ability to take real control of their cool season ventilation. The Hemisphere Mixing Fan provides the superior cool season ventilation solution for layer, broiler, and pullet houses. It destratifies the air in poultry housing environments throughout cool seasons resulting in less moisture, lower condensation, drier litter, reduced ammonia, lower fuel costs and healthier, high producing birds. ■

References are available from the author on request