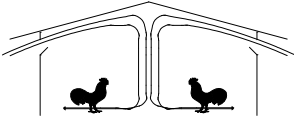




The University of Georgia

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Poultry Housing Tips

Retrofitting Tunnel Houses to 600 ft/min can be Costly

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Though keeping any market age bird cool on a hot summer day can prove to be a difficult task, for producers growing birds to an age of 50 or more days it can be especially challenging. Large broilers tend to be better feathered, less mobile, placed at a higher stocking density (lbs/ft²), and have less surface area per pound of weight than birds grown to a weight of four to five pounds. Because of these differences, research trials have indicated that a large broiler may require 50% or more air speed than smaller broilers to optimize weight gains and feed conversions during hot weather.

Where growing large broilers can be especially problematic is in houses where the tunnel ventilation system was originally designed to cool a four or five pound broiler. In these houses, producers can find themselves in the unenviable position of not looking to obtain optimal feed conversions and growth but just simply trying to keep heat stress related mortality from becoming excessive. Recently a study was conducted on a farm where this was the very case. The tunnel ventilation system in the ten-year-old, 50' X 500' broiler houses on the farm was originally designed for a four pound broiler. Approximately three years ago the grower switched to a poultry company growing an eight pound broiler. For most of the year the switch in bird size did not prove to be overly problematic, but during hot weather keeping the large birds cool proved especially challenging. In particular, this past summer the producer lost over 20% of his 50 day old broiler on one very hot, humid day.

To provide the producer with some answers as to how this situation could be avoided in the future, the tunnel ventilation system in one of the houses on the farm was evaluated in depth. The objectives of the study were to accurately determine: the average wind speed in the house, if fan or pad maintenance adversely affected the air moving capacity of the tunnel fans and lastly how much additional fan capacity would be required to obtain an average air velocity of 600 ft/min.

The dropped ceiling house where the tests were conducted was equipped with ten 48" slant wall fans, one new 50" "butterfly" shutter fan and a single 36" slant wall fan. The side wall height was 7' 2", the peak height was 11' and the internal house width was 49' resulting in a house cross sectional area of approximately 445 square feet. The house was equipped with a total of 160 linear feet of four-foot-tall, six inch evaporative cooling pad.

The average tunnel velocity was determined using 15 data logging anemometers. The anemometers were installed on five poles with three anemometers per pole. The poles were evenly spaced across the width of the house approximately 100' from the tunnel fans. Air velocities were measured two feet from the ceiling, as well as two and four and half feet above the floor. No birds were present during the time that air velocity measurements were being taken.

With all the fans operating, the air velocity measured by the 15 anemometers ranged between 330 and 460 ft/min (Figure 1). The average air speed was 380 ft/min, which is significantly less than the +600 ft/min air speed that is generally recommended for growing a large broiler. The static pressure, measured 20' from the tunnel fans, was 0.08".

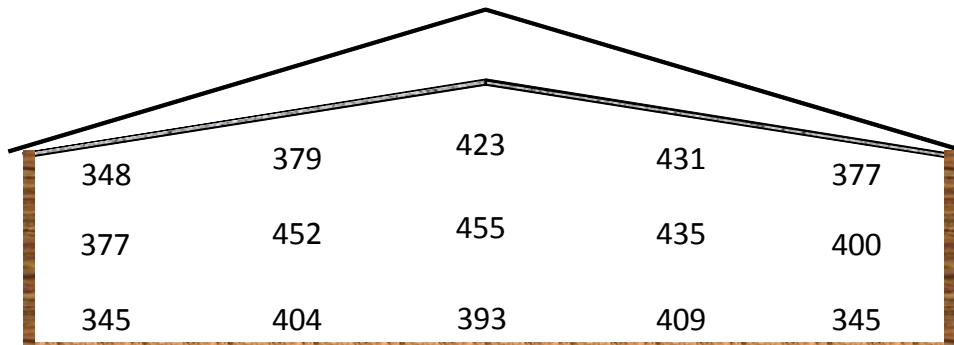


Figure 1. House air velocity profile (ft/min).

Since the majority of the tunnel fans in the house were the 48" slant wall fans a series of tests were conducted to determine not only how much air each of the 48" fans was moving, but how things such as removing the shutters, replacing the belts, and/or lowering the static pressure would affect the air moving capacity of the 48" fans (Figure 2).

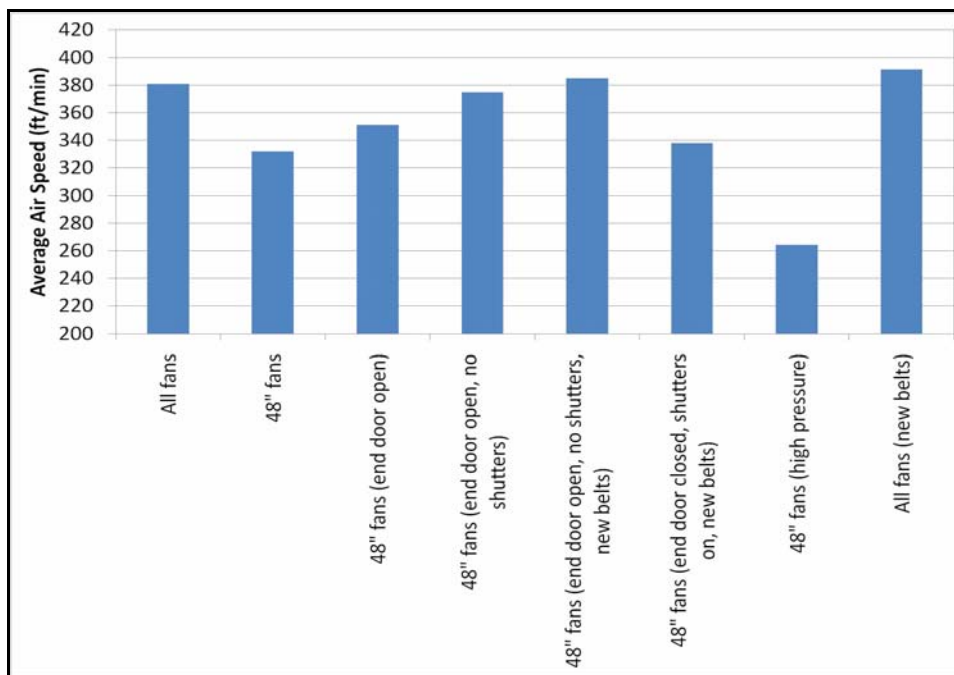


Figure 2. Average house air velocity under various conditions.

Using only the ten 48" fans the average air speed decreased to approximately 50 ft/min to 331 ft/min. Using the relationship that air moving capacity of the fans is equal to average house air velocity multiplied by the cross sectional area of the house it was determined the amount of air moved by each of the 48" fans was approximately 14,700 cfm (@ 0.072"). The end wall door was then opened to determine if the air speed produced by the fans could be increased by lowering the static pressure.

By opening the end wall doors the static pressure decreased to 0.045" and the air speed increased slightly to 351 ft/min thus indicating that static pressure was unlikely adversely affecting fan performance. The fan shutters (cleaned a few days prior to testing) were then removed to determine how much they were affecting the air moving capacity of the fans. With the shutters removed average air speed again, increased slightly to 375 ft/min (@ 0.046"). The slight change in air speed indicated that the shutters were not significantly affecting the air moving capacity of the fans. New belts were then installed and the average air speed increased an additional 10 ft/min to 385 ft/min. (@ 0.05"). As a result of this testing it was determined that in a best case scenario (very low static pressure, new belts, no shutters) that the existing 48" fans could move a maximum of a 17,100 cfm, which is significantly less than the 20,000 cfm typically assumed for a 48" slant wall fan. In a more typical operating mode (end wall doors closed, fan shutters on, moderate static pressure) the average air moving capacity of the fans decreased to 15,100 cfm (0.079") resulting in a decrease in average air speed to 338 ft/min. With the addition of the 50" and 36" fans the average air speed increased to 391 ft/min (0.10") which would generally be viewed as marginal for growing even a four pound broiler during hot, humid weather.

In order to determine how much fan capacity would be required if the producer desired to increase the average air speed to 600 ft/min, it was first necessary to determine how much the existing 48" fans would move at static pressure more typical of what one would typically expect to see in a house with an average air velocity of 600 ft/min or greater (0.15", see *Poultry Housing Tips*. High Air Speeds = High Static Pressures. Vol. 22 no. 8). The tunnel curtains were partially closed to mimic a high static pressure situation (0.14") and the air moving capacity of the 48" fans was found to decrease to 11,800 cfm. When the air moving capacity of the 50" and 36" fans were added (21,000 cfm and 7,000 cfm @ 0.15" respectively) the total air moving capacity of the existing fans was calculated to be approximately 146,000 cfm. To obtain an air speed of 600 ft/min in a house with a cross-sectional area of 445 square feet approximately 267,000 cfm (600 ft/min X 445 ft²) of tunnel fan capacity is required (@ 0.15"). Therefore, to obtain an average air velocity of 600 ft/min the producer would need to add approximately 121,000 cfm of tunnel fan capacity @0.15" (267,000 cfm - 146,000 cfm).

This particular house illustrates the challenges in obtaining an average air speed of 600 ft/min in many older tunnel houses. First, the true air average air velocity in many houses is significantly lower than typically assumed or measured. Often air velocity measurements are taken towards the center of the house where air velocities tend to be 20 to 40% higher than near the side wall. For instance, in this particular case while centerline velocities were close to 500 ft/min, the true average velocity was just under 400 ft/min due to the fact that air velocities near the side wall were in the neighborhood of 350 ft/min. Making matters worse is measurements also tend to be taken four to five feet above the floor which tend to be significantly higher than they are at floor level. Secondly, the air moving capacity of the existing fans is often overestimated. Fan performance test literature often used to calculate a house's required tunnel fan capacity are a "best case" scenario, not what the fan typically moves in the field, especially after five to ten years. Last but not least, the operating static pressure in houses where the average air velocity is 600 ft/min+ is higher than many people assume, which again lowers the actual air moving capacity of a house's fans. All of these factors combine, resulting in the fact that in many older houses to obtain an average air velocity of 600 ft/min or more may require increasing tunnel fan capacity by 50% or more.

To meet the demands of the additional tunnel fan capacity the evaporative cooling pad area typically has to be proportionally increased. Depending on the situation, well pump capacity may need to be increased and the farm's water distribution system may need to be modified to meet the increased demand of the larger evaporative cooling system. Furthermore, electrical systems may require upgrading as well as the farm's standby generator. In the end, obtain a tunnel air velocity of 600 ft/min or more may require significantly more than just adding a tunnel fan or two.


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