Completed Research

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Project #F034: "Factors Determining Air Velocity Distribution in Tunnel-Ventilated Broiler Houses"

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INDUSTRY SUMMARY

Approximately 80% of the cooling produced in a modern tunnel-ventilated poultry house is the result of wind speed moving over birds. Airspeeds across the cross-section of a house may vary 30% or more resulting in significant differences in bird cooling at different areas of the house (side wall vs. center). In new poultry house construction, airspeeds from 600-900 ft/min are being targeted. Little work has been done in documenting factors affecting air velocity in tunnel-ventilated poultry houses. The objective of this study was to determine what factors affect cross-sectional air velocity distribution in tunnel-ventilated broiler houses. In the past, air velocity profiles in poultry housing have been measured at one level. The current study used a grid of 15 anemometers (ceiling to floor–wall to wall) located 50' in front of the tunnel fans to measure the cross sectional air velocity. Pressure sensors were installed at the pads, inlet, quarter house, and three-quarter house to measure static pressure. Air velocity and static pressure were monitored with several fan capacities varying between 100% and 50% of all tunnel fans operating. These measurements were taken in a total of 27 poultry houses (less than two years of age) from four companies (Including 24 broiler houses, one commercial layer house, one pullet house and one breeder house).

High static pressure makes fans work harder but move less air. Therefore, static pressure has been kept as low as possible in the past to keep fans operating at optimum efficiency. In this study, the data show static pressure increases as house air velocity increased. In the newer houses, the cross-sectional air velocity did not vary more than 10% across the house width. This was due to the smoothness of the side-wall construction and few obstructions down the house length. In houses with smooth side walls, the average airspeed in the house can be estimated by measuring air movement at the side feed lines. As more obstructions are introduced and side wall smoothness decreases, additional measurements across the house width will be required to estimate average house air velocity. Static pressure increased as air moved down the length of the house. While static pressure is usually measured at the house center, it is important to remember that the total pressure the fans are working against is slightly higher when measured at the rear of house near the tunnel fans.

In older houses (airspeeds of 400-500 ft/min) the largest factor in static pressure was the tunnel inlet. If the inlet was too small then pressure would be high. In those cases, the producer would increase the size of the tunnel inlet to maintain a low static pressure. In modern high airspeed houses, the tunnel inlet is not the main factor in static pressure increase. Instead the transitional pressure where the air makes the turn into the house is the main contribution to total static pressure. This means that in houses with 600 ft/min or more airspeed increasing the tunnel inlet size will not result in lower airspeeds. In fact, oversizing the tunnel inlet (usually done in length) can actually make airspeed distribution along the length of the tunnel inlet worse. The data from this study indicates that tunnel openings in the house can be smaller than the evaporative cooling pad opening, which improves the air distribution along the length of the inlet without significant impact on the static pressure that the fans are working against. In conclusion, it is recommended that poultry companies targeting higher airspeeds design their fan requirements at higher static pressures than the traditional design pressure of 0.1 inches of water column. House static pressure should be measured near the fans at least once a year. In being mindful of these influences on air velocity, the air movement in poultry houses will be maximized and the losses in hot weather can be minimized.