The *Poultry Engineering, Economics & Management*
NEWSLETTER

Critical Information for Improved Bird Performance Through Better House and Ventilation System Design, Operation and Management

Auburn University, in cooperation with the U.S. Poultry & Egg and Alabama Poultry & Egg Associations
Issue No 42, July 2006

Big Birds, Hot Weather – and Maximum Comfort, Performance and Profit

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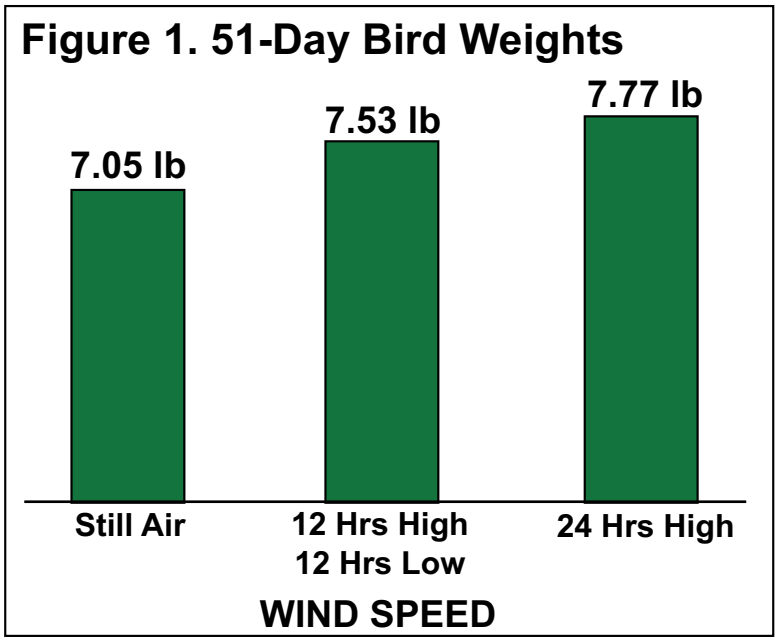
Hot weather is here and poultry growers are struggling to keep their birds growing through the toughest times of summer. Of course, those with tight tunnel houses that can provide at least 500 feet per minute (FPM) wind speed with good evaporative cooling perform better than those with houses that don't measure up. Much of the recent research that has been released indicates that we should be looking at 600 FPM wind speed or more for big bird houses. But no matter how your houses are equipped, house tightness, fan maintenance, and cool cell maintenance are all critical for maximizing bird comfort and flock performance in hot weather.

Many newsletters have been written on house maintenance. House tightness is usually a maintenance issue and is a fundamental requirement for achieving our ventilation goals, especially in hot weather. In this newsletter, however, we will focus especially on problems and trends that we are seeing in the field.

On many of our farms growing bigger birds, some of the tunnel fans are coming off line at night due to cooler night time temperatures. However, growers should realize that when we lose cooling capabilities at night with big birds after a hot day we are leaving money on the table because we are failing to get the residual heat removed from the bodies of the birds.

The graphic at right shows results from a study at the USDA-ARS poultry research unit at Mississippi State, MS, designed to find out just how important high wind speed might be in growing big birds and whether there would be an advantage to maintaining high wind speed for 24 hours a day in the last two weeks. The study compared 51-day birds grown in still air, birds grown with 550 feet per minute (FPM) tunnel wind speed in daytime and 320 FPM at night, and birds grown with 550 FPM wind speed 24 hours a day. As the bar graph shows,

Maintaining 550 feet per minute wind speeds 24 hours a day in the last two weeks of a big bird growout has been shown in one realistic USDA study to pay off as much as a quarter-pound in additional weight gain. Is it worth the added electricity cost? Almost certainly, yes–see explanation in text.



birds grown under 24-hour high wind speed conditions had almost a quarter-pound better weight than the birds grown under the 12 hours high/12 hours low regimen. As would be expected, birds grown in still air trailed far behind.

The USDA study was a realistic one, with approximately 1500 male birds placed in a test chamber from 37 to 51 days of age. Temperature was controlled for all three trials, cycling from 77 degrees for 12 hours at night to 86 degrees for 12 hours in daytime. This was done to simulate equivalent day time high temperatures in a properly designed tunnel ventilated broiler house with active cooling and comparable night time temperatures that normally exist.

In addition to the weight gain advantage over the 37 to 51 day period, the birds in the 12/12 hour house trailed the 24 hour continuous fan house by 15 points and the birds in the still air house trailed by 26 points in feed conversion (see Figure 2 on opposite page).

Often growers say they cut fans off at night to save energy. Are the weight gain and improved feed conversion benefits worth the added cost in electricity to run fans 24 hours a day for two weeks? Let's look at two growers, one that runs 12 fans at night versus one that runs only eight fans at night to save on his power bill. Typical fans for this comparison are 17 CFM per watt energy efficient with electricity costing $.09/kWH. Grower A runs 12 fans 24 hours a day achieving approximately 550 FPM wind speed for the last two weeks of his growout. Grower B runs 8 fans at night and 12 fans during the day time. Grower B is only achieving 320 FPM wind speed at night.

The achieved effect of the additional ventilation, based on the Mississippi State USDA studies, will be at least 0.20 pound gain per bird. If 20,000 birds are present in the house the total additional liveweight produced will be 4,000 pounds. At $0.05 per pound of liveweight, grower pay will be an additional $200 per house gross return. This does not include any value for increased feed conversion, livability, or improved settlement. Cost of electricity for the additional fan run time is only $71.30. Subtracting the $71.30 in added electric cost from the additional liveweight value of $200 leaves a net income improvement for cooling the birds at night of about $128.70 as a very conservative estimate.

The theory behind the idea of maintaining high wind speed through the night can be seen by looking at work that was done at the University of Georgia Extension Service and printed in their Newsletter entitled "Poultry Housing Tips, Are You Cooling Your Birds at Night", Volume 15, #6, July 2003.

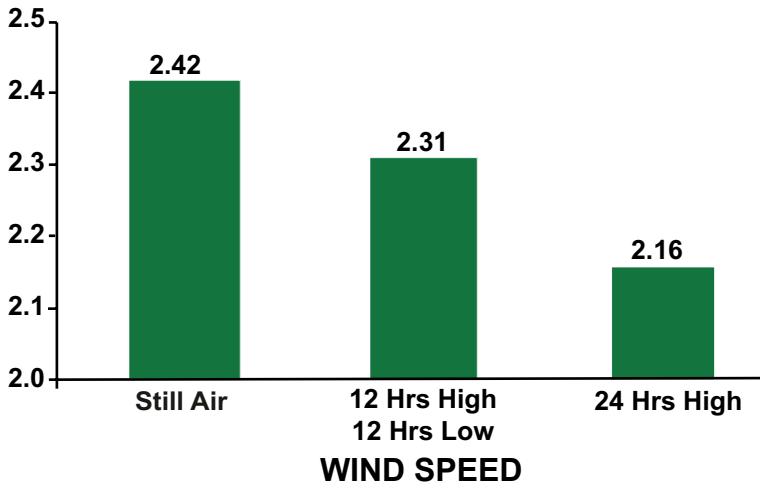
Figure 3 (opposite page) is from a study on wind speed effects on body temperature of heat stressed birds. A single bird was placed in a chamber where the temperature was in the mid 80's and there was no air movement. Over the course of five hours the bird's body temperature rose, indicating the bird was unable to get rid of all the heat it was producing. Five hours into the study a fan was turned on, providing approximately 100 FPM wind speed over the bird. As the air moved over the bird's body, the heat was pulled from the bird, slowly lowering its temperature.

Figure 4 illustrates how increasing the air speed to 400 feet per minute dramatically increased bird cooling. Whereas 100 FPM wind speed lowered the heat stressed bird's temperature approximately 0.3 degrees per hour, 400 FPM wind speed lowered the temperature over 0.7 degrees per hour. From this study it can be seen that with the slower wind speed of 100 FPM it takes much longer to pull the heat from mildly heat stressed birds. This data indicates that in hot summer conditions if the internal core body temperatures of birds rise to a mildly heat stressed level, it can take many hours at night to remove the heat that caused the heat stress.

Often at night, ambient air temperatures drop 20 to 25 degrees below daytime highs. So it is understandable that growers would think it makes sense to let sensors turn off some of the tunnel fans. But this makes sense only for smaller birds. When these fans are taken off line and the wind chill effect on the larger birds is greatly reduced, they may not be able to shed all of the heat from their bodies during the night. When you have big birds, not letting the fans operate through the night to remove the deep core body heat from the birds may save a few dollars on electricity cost, but is highly likely to lose the grower more in poorer feed conversion and lower final bird weight.

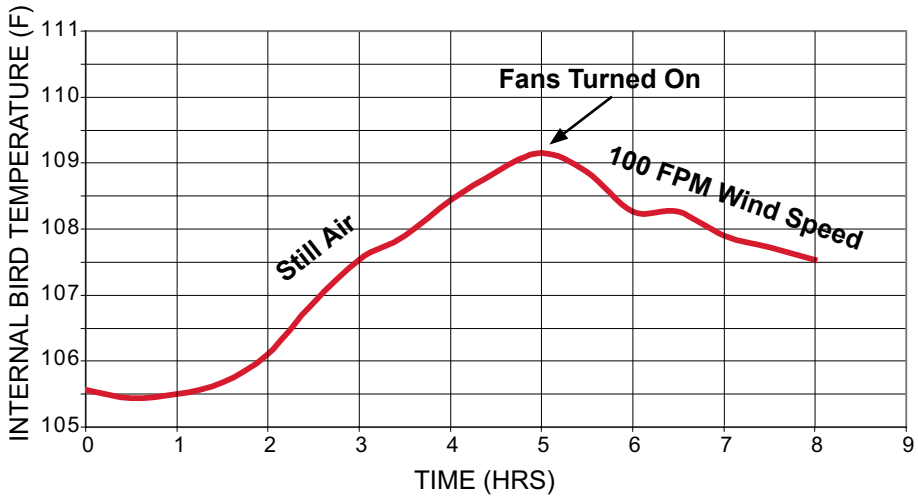
BENEFITS OF HIGH WIND SPEEDS IN VERY HOT CONDITIONS

Figure 2. 37-51 Day Feed Conversion



In a USDA study, when full tunnel ventilation with high wind speed was maintained for 24 hrs a day in the last two weeks of a 51-day grow-out, feed conversion was 15 points better for that two-week period than when some tunnel fans were turned off at night. Birds in the 24-hr high speed trial also had an almost one-fourth pound weight advantage – see Figure 1 on front page.

Figure 3. Cooling Effect of 100 FPM Wind Speed

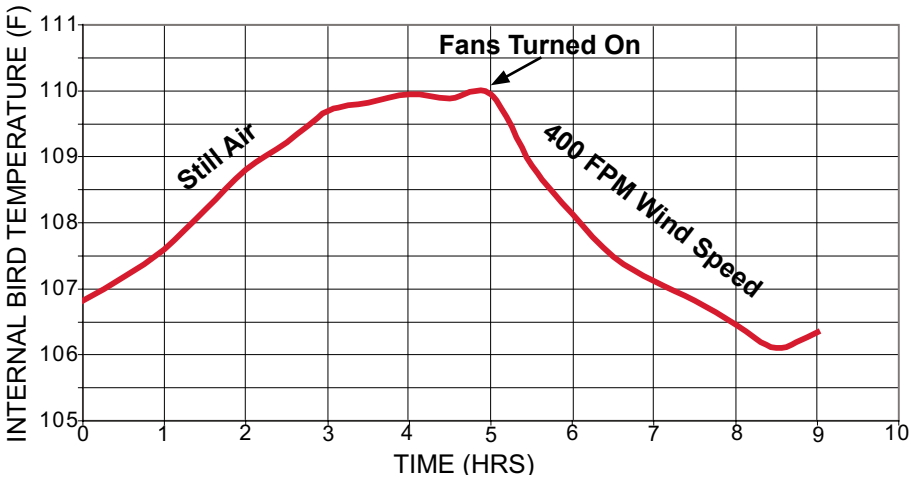


In controlled studies, when birds were placed in a chamber with temperature maintained at 85ºF, and in still air, their core body temperatures would rise to dangerous levels.

Turning on high wind speed in the chamber reduced bird temperature much more rapidly than low speed wind.

Study shows benefits of using high wind speed to help birds shed excess body heat.

Figure 4. Cooling Effect of 400 FPM Wind Speed



The Bottom Line

Tunnel ventilated houses have been in operation in the Southeastern United States for about 20 years. They have evolved from crude houses equipped with fans on one end and windows on the other to the modern evaporative cooled houses we see in production today. It has taken much research and observation to learn how to manage the technology of tunnel ventilation and there is still much to learn.

There are two important take home messages presented in this newsletter:

1. A primary goal of hot weather tunnel ventilation is to remove the heat from the house. This is done by using air flow supplemented by properly using the evaporative cooling system or the cool cells that are on the house. Removing heat from the house must be done not only during the day, but at night as well. The importance of nighttime ventilation is often underestimated. Heat removal is affected by house tightness, fans, insulation, and other physical characteristics of the house.

2. A second goal of hot weather tunnel ventilation is to remove heat from the birds. This is the function and purpose of air velocity. It is possible to remove the heat from the house without doing a good job of removing the deep heat from the birds. Research study after research study has shown that higher wind speeds help reduce the inner core body temperatures of large birds and result in more rapid growth rate, better feed conversion, and improved livability. Further, for larger birds, high wind speed may be needed 24 hours a day.

A well-equipped tunnel house represents a considerable investment, and should be used to the fullest extent when it is really needed in order to get the best return on this investment. It is possible even in very hot weather to keep big birds comfortable and get maximum profit every growout.

For further information on hot weather ventilation, see the following newsletters at www.poultryhouse.com:

No. 17, Getting Broiler Houses Ready for Hot Weather (May 2002)
No. 24, Getting Best Broiler Performance in Hot Weather (July 2003)
No. 30, Fan Belts, Pulleys, Shutters, Cool Pads – And Profits (July 2004)
No. 41, Keys to Top Evaporative Cooling Performance (May 2006)

U.S. Poultry & Egg ASSOCIATION

This newsletter is produced in cooperation with the U.S. Poultry & Egg and Alabama Poultry & Egg Associations, as part of their commitment to poultry industry education. We appreciate their support and are proud of our relationships with these organizations.

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ALABAMA COOPERATIVE Extension SYSTEM

The Poultry Engineering, Economics and Management Newsletter provides up-to-date information on topics of interest to poultry production personnel, focusing on most effective and efficient uses of modern technology and equipment, with a special emphasis on economic implications. The Newsletter is published six times a year, or as needed to address emerging or special issues. Contact: Jim Donald, Extension Biosystems Engineering, 228 Corley Bldg., Auburn University, AL 36849-5626, (334) 844-4181, fax (334) 844-3548, jimdonald@aces.edu. Published by:

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