The University of Georgia

College of Agricultural and Environmental Sciences
Cooperative Extension

Poultry Housing Tips

How Much Do Evaporative Cooling Pads Reduce Air Speed?

Volume 25 Number 4 **April, 2013**

Figure 1. Study house with evaporative cooling pads removed.

Though evaporative cooling pads can do a great job of keeping our birds cool during hot weather by reducing the temperature of the incoming air 20°F or more, it is important to keep in mind that this cooling comes at a price, namely increased humidity and reduced air speed. Though there is no practical way of reducing the humidity produced by evaporative cooling pads without reducing the cooling, the reduction in air speed caused by the restrictive nature of pad systems can be somewhat offset by simply increasing the amount of pad installed on a house. As pad area is increased, the velocity through the pad decreases, which in turn lowers the static pressure the tunnel fans are working against. As static pressure decreases, the air moving capacity of the fans increases, which leads to higher air speeds, and therefore increased bird cooling. The question of course is exactly how effective is increasing pad area in increasing air speed/bird cooling?

A study was conducted on a recently retrofitted 40' X 500' broiler house to examine the effect evaporative cooling pads have on static pressure and air speed in a tunnel-ventilated house. The test house was equipped with nine 48" slant wall fans and three 54" slant wall fans with discharge cones, which together moved approximately 220,000 cfm (@ 0.12"). The house was also equipped with two, 76' X 5' X 6" evaporative cooling pad systems along with five-foot tall tunnel doors.

Five poles, with three anemometers on each pole, were evenly spaced across the width of the house approximately 100' from the tunnel fan end wall. The anemometers were mounted on each pole two feet above the floor, two feet below the ceiling and 4.5' above the floor. Each of the 15 anemometers were connected to a data logging system that recorded air speed every minute for 20 minutes. The 15 anemometers allowed a very accurate determination of the average house air velocity. Static pressure was measured 100' from the pad inlet end wall, 50' from the fan end wall, as well as at the center of the house.

Instead of evaluating air speed in the house with different amount of pad areas, a more simple study approach was taken; compare air speeds in a house with and without the pads. This method of testing would essentially show what the maximum increase in air speed a producer could ever expect by increasing pad area. Basically a best case fan performance scenario...no pads.

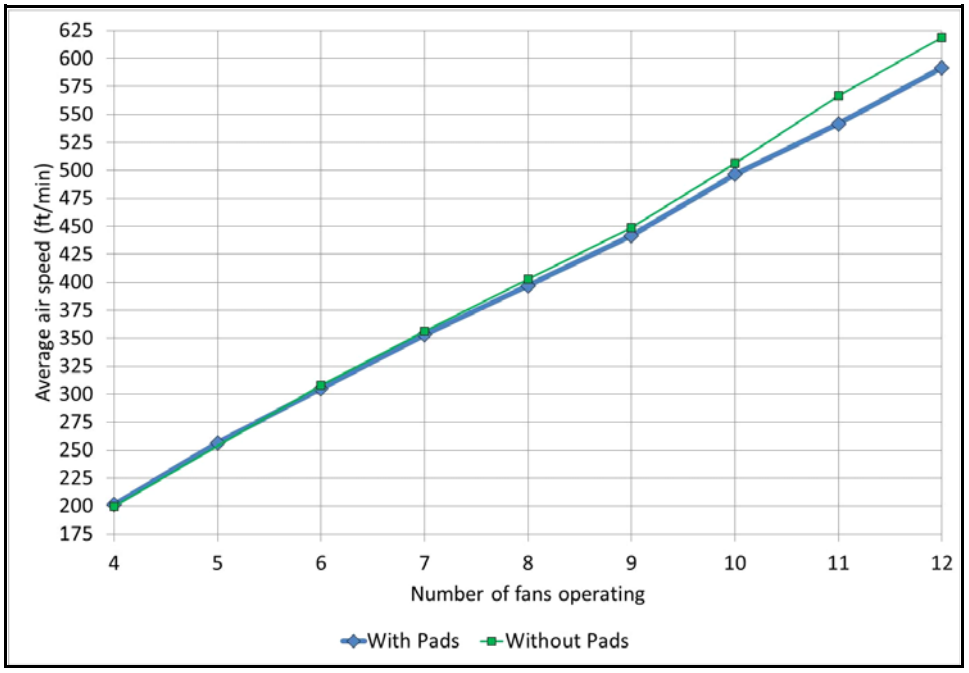

Figure 2. Average air velocity with and without evaporative cooling pads.

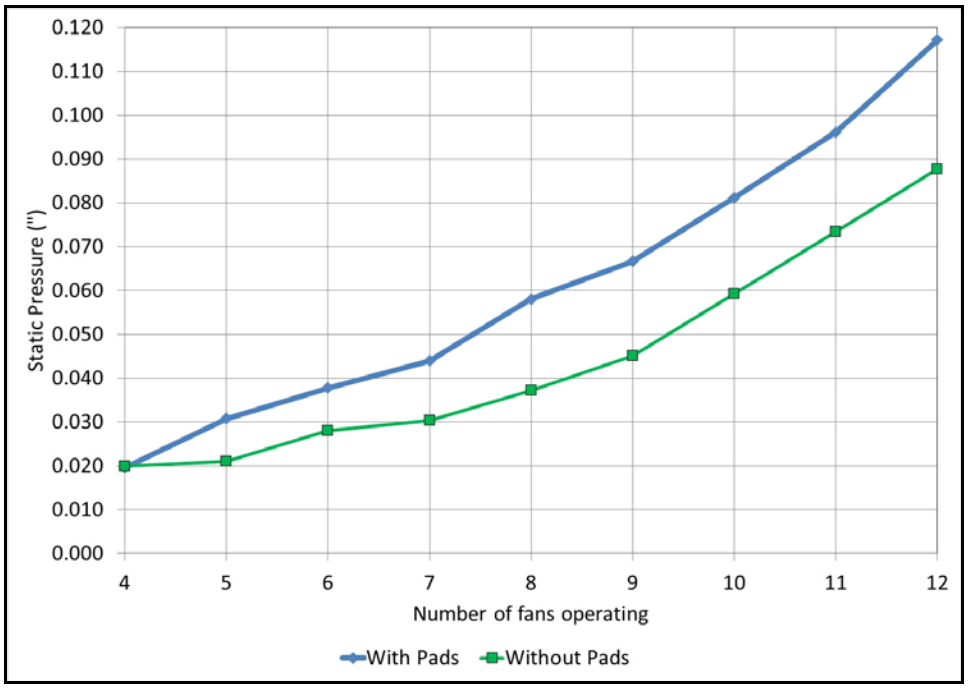

Figure 3. Fan static pressure with and without evaporative cooling pads.

Figure 2 shows the average air velocity in the test house with and without the evaporative cooling pads installed with between four to twelve tunnel fans operating. Fans four through nine were 48" slant wall fans, while fans 10, 11, 12 were 54" slant wall fans with discharge cones. With the tunnel doors fully opened there was no practical difference in air speed (less than 10 ft/min) between the house with and without pads when between four and nine 48" plus one 54" fan were operating. When fans 11 and 12 were turned on air speed was reduced by the presence of the pads between 20 and 25 ft/min respectively.

The reason there wasn't a large increase in air speed when the pads were removed is due to the simple fact that there was not much of a decrease in the total static pressure the fans were working against. The greatest difference in pressure between the house with and without pads was only 0.03" which didn't occur until all the fans were operating (Figure 3). A three point difference in static pressure will reduce the air moving capacity of the typical fan by about three percent. A three percent difference in fan performance in the test house would reduce air speed of roughly 20 ft/min, which was approximately what was measured.

It is important to realize that the pads in a tunnel house are not the only source of work/pressure that the tunnel fans are working against (see *Poultry Housing Tips* Vol 24n5). In addition to the pad pressure, there is the transition pressure caused when the air entering through the relatively large tunnel openings has to move into the smaller cross-sectional area of the house. Furthermore there is the "pipe" pressure caused by the slight resistance to air moving down the length of the house. Lastly, even though the pads were removed there was still a slight pressure/work required to pull air in through the tunnel opening. The total of all of these different areas of work in the test house when the pads were removed still amounted to pressure of 0.09" that the tunnel fans were working against.

In a house with new pads the pressure drop across the pads is typically between 0.03" and 0.05", depending on how the pad area was sized. A pressure increase of 0.03" to 0.05" will reduce the air moving capacity of the typical tunnel fan between three and seven percent which in most houses will correspond to a decrease in air speed of less than 50 ft/min. So for the most part the presence of evaporative cooling pads does not decrease air speed dramatically and as one might expect increasing pad area over what is typically recommended by poultry ventilation equipment manufacturers will not result in significant increases in air speed.

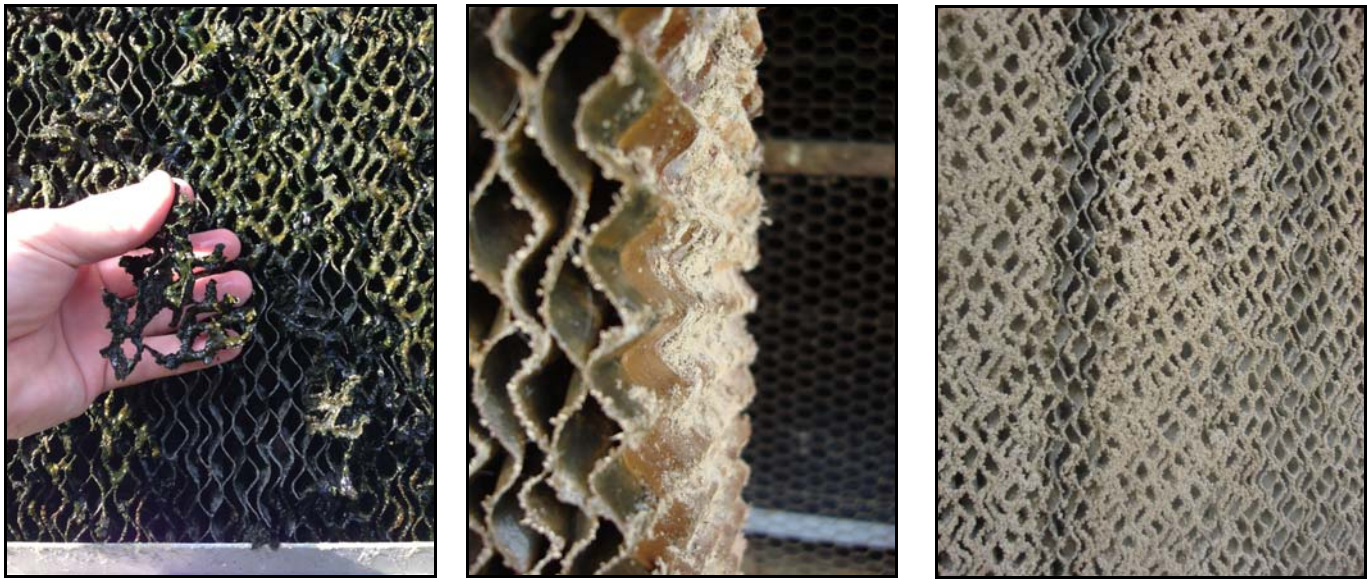

Figure 5. The static pressure required to pull air through a pad can increase dramatically when it is not regularly cleaned

This doesn't mean that evaporative cooling pads can't dramatically decrease air speed in a tunnel house. Though a new pad might only increase the static pressure the fans are working against by a few points, if a pad is not kept clean the pressure can increase dramatically over time (Figure 5). The work/pressure require to pull air through a dirty pad can twice that required to pull air through a clean pad, thereby increasing the pressure required to pull air though the pads alone to possibly ten points or more. When this very high pad pressure is added to the transition, and pipe pressures the total static pressure fans are working against can be over 0.20" resulting in a reduction of air speed of 100 ft/min or possibly more. If the fans are not properly maintained, the decrease in air speed and bird cooling will be even greater.

The fact of the matter is that pads, when properly maintained, do not cause a significant reduction in wind speed in a modern tunnel-ventilated house. It is the lack of proper maintenance to pad systems and fans that can cause problems during hot weather not necessarily the pads themselves. Increasing pad area above what is generally recommended may decrease pressure slightly and result in a very slight increase in air speed but is it worth the investment? Long term– a grower's ability to

maximizing air speed in a tunnel house has much more to do with how well a pad system is maintained than the precise amount of pad installed on a house.

Michael Czarick
Extension Engineer
(706) 542-9041
mczarick@uga.edu
www.poultryventilation.com

Brian Fairchild
Extension Poultry Scientist
(706) 542-9133
brianf@uga.edu