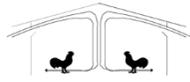




The University of Georgia

Cooperative Extension Service

College of Agricultural and Environmental Sciences/Athens, Georgia 30602-4356



Poultry Housing Tips

Volume 5 Number 8

Negative Pressure Ventilation -
"How Many Fans Do I Need?"

October-November, 1993

"How many exhaust fans do I need for wintertime ventilation?" is a question that many broiler producers ask when constructing a new house or remodeling an older one. There is a quick and easy answer. As a general rule, a broiler house should have 15,000 ft³/min of fan capacity (one and a half 36" fans) for every 100' of house length. Therefore, a 400' house would require the equivalent of six 36" fans and a 500' house about eight. Soon after having that question answered, most growers have a second question, "Why?" This question takes a little more than a sentence or two to answer.

Exhaust fans have two very important functions in a poultry house during cold weather: the first is to control air quality, the second is to control house temperature by ridding the house of excess heat. Many houses could get by with two or three 36" fans on timers to control air quality and/or moisture. After all, when was the last time you had to run three fans continuously to control ammonia? If you think about it, in most cases, three 36" fans running six minutes out of ten would probably do a very good job of keeping the air fresh in a 400' house with seven-week-old birds. But how good of a job would the same three fans do getting rid of excess heat?

At first it may be hard to believe that excess heat could ever be a problem during the winter, but it can. From the day they are born, birds produce heat. The amount of heat birds produce increases as they grow. A house full of one-day-old chicks produces about 35,000 Btu's of heat each hour. To put this into perspective, to keep a house 90° when it is 30° outside requires 400,000 Btu's of heat to be added to the house each hour. Since the birds are only producing 35,000 Btu's/hr, an additional 365,000 Btu's/hr need to be supplied to keep the house 90°, hence the need for furnaces and brooders.

Though the amount of heat the birds produce at day one is fairly insignificant, the picture changes quite dramatically as the birds get older. A flock of seven-week-old birds produces nearly 600,000 Btu's of heat each hour, more than enough heat to keep the house 90° when it is 30° outside without having to supply any additional heat. This may seem far-fetched at first, but if you were to shut off your timer/exhaust fans you would see how fast your houses would heat up. In fact, with all the fans off, the air temperature would increase to nearly 90° in just 15 minutes, after which the birds would soon begin to die due to heat stress.

The bottom line is that the birds in a house are always producing heat. This results in inside air temperature being higher than outside air temperature. Exhaust fans help to rid a house of the surplus heat generated by the birds by drawing in cooler outside air and exhausting the hot air inside the house.

It stands to reason that the more exhaust fans a grower turns on, the less bird heat retained and the closer the house temperature will be to outside air temperature. The following graph (Figure 1) illustrates how the number of fans running affects the difference between inside and outside temperature in a 400' house with birds seven weeks old. For example, on a cold day the birds would produce enough heat in the house that two 36" fans could be run continuously, and it would be about 30° warmer inside the house than outside. So if it were 40° outside it would be 70° inside. If it were to heat up to 50° outside, inside house temperature would increase to 80° and an additional fan would have to be turned on to draw in more cool air if we wanted to keep it 70°. If it were to drop to 30° outside, and we ran two fans continuously, it would be 60° inside. To keep it 70°, we would have to turn a fan off, put both the fans on timers, or burn more gas.

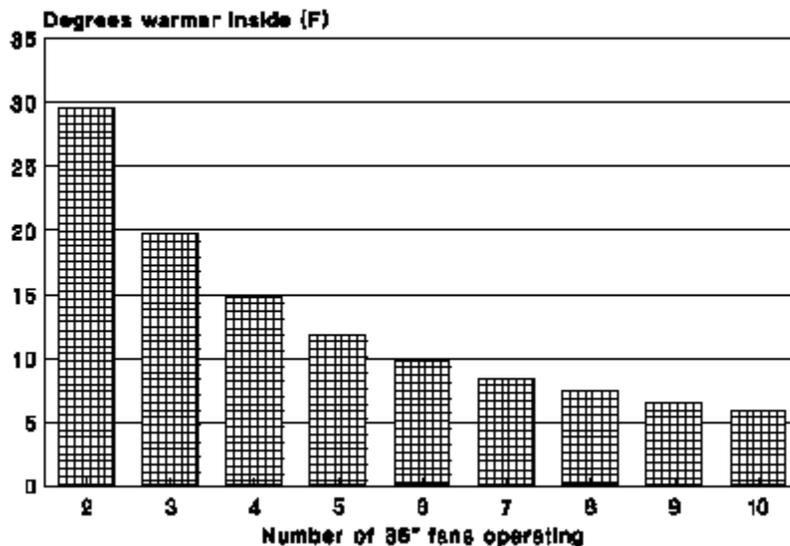


Figure 1. Temperature Difference as Affected by the Number of Exhaust Fans Operating.

Figure 2 illustrates another way of looking at the same phenomenon. At an outside air temperature of 50° with seven-week-old birds in a 400' house, approximately three fans are required to keep a house 70° inside. If fewer than three fans are operating the house temperature will exceed 70°. If more than three run, the house temperature will drop below 70°.

Figure 2 can be used to answer the question, "How many exhaust fans does a house need for wintertime ventilation?", but first you must answer the question, "When do you want to start using natural ventilation?" The number of exhaust fans a house has determines when a grower has to go to curtain ventilation. The more exhaust fans a grower has in his house, the longer he can wait. For example, if you want only to power ventilate until it is 40° outside, then all you need are two 36" fans. The problem is that if outside temperature exceeds 40° and a grower wants an inside house temperature of 70°, he doesn't have any other exhaust fans to cool the

house off. The grower's only option in this case would be to go to natural ventilation. Using natural ventilation at such a low outside temperature will lead to difficulties in controlling house temperature and draftiness, as well as litter caking problems.

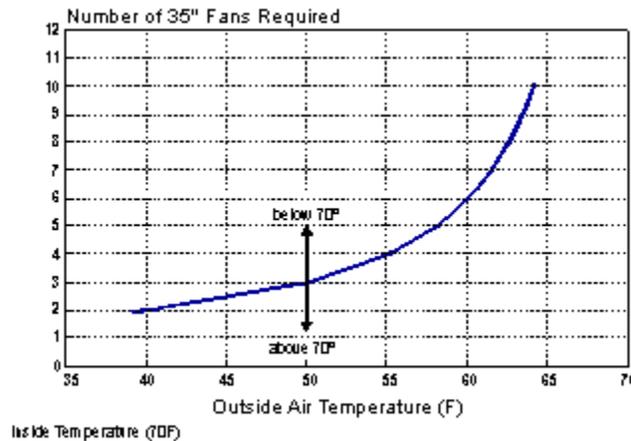


Figure 2. Number of Fans Required to Maintain 70° in a 400' House with Seven-Week-Old Birds

On the other hand, if a grower wanted to be able to power ventilate until it is 65° outside and still maintain an inside temperature of 70°, ten fans would be required. Of course, in most cases, ten fans are too many to have to install, so we compromise. Most growers would agree, if you could power ventilate until it is 60° outside, going to natural ventilation would not present any problems. For the average 400' broiler house, six fans would be required to accomplish this goal. Since a 500' house is 25 percent larger than a 400' house, 25 percent more fans (two and a half) would be required.

One of the benefits of delaying going to natural ventilation until it gets fairly warm outside is that there is less of a chance of a house cycling back and forth between power ventilation and curtain ventilation. When a house only has a few exhaust fans, the curtain machine may begin to drop the curtains due to the build up of heat even when it is still very cold outside. This results in a sudden drop in house temperature. The curtain machine then closes the curtains, and the fans go back to running off of timers. After about 15 minutes the house heats up again, the few sidewall fans can't cool off the house enough and the curtain machine starts to bring down the curtain and the cycle begins again. During one of these cycles it is not uncommon to see as much as a 15° swing in house temperature.

It is important to realize if a house is tunnel-ventilated, the 48" fans used for summertime ventilation can be used in place of 36" fans. Therefore, a 400' house may only require two 36" side wall fans and use two 48" fans in the rear of the house to provide the rest of minimum ventilation needs.

By having an adequate number of minimum ventilation fans, providing the proper environment during the fall, winter and spring becomes a fairly easy task. As outside temperatures change from 20° to 60° exhaust fans will come on to maintain the desired house temperature even

without a grower having to worry with switching back and forth between power and natural ventilation.

Michael Czarick
Extension Engineer
(706) 542-9041
(706) 542-1886 (FAX)
mczarick@bae.uga.edu

Mike Lacy
Extension Poultry Scientist
(706) 542-9153
(706) 542-8383 (FAX)
mlacy@uga.cc.uga.edu

Putting Knowledge to Work

The University of Georgia and Ft. Valley State College, the U.S. Department of Agriculture and counties of the state cooperating.
Publication made possible by U.S. Department of Energy Oil Overcharge Grant through the Georgia Office of Energy Resources.
The Cooperative Extension Service offers educational programs, assistance, and materials to all people without regard to race, color national origin, age, sex or disability.
An equal opportunity/affirmative action organization committed to a diverse work force.