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Circulation Fan Placement in Curtain-Sided Broiler Houses (warm weather operation)

By: Mike Czarick, Extension Engineer

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The effective use of circulation fans in a broiler house has evolved over time. Twenty years ago there were very few broiler houses with any type of circulation fans. Houses were narrow enough and densities were low enough that heat stress was usually not a major problem. As bird densities and the size of broiler houses increased, producers discovered that if they installed a few fans here and there, fewer birds died and performance increased. Every time a house got larger or bird density was increased a few more circulation fans were installed. The basic rule of thumb: more birds = more fans.

In recent years, many in the poultry industry have started putting the number of circulation fans required for summertime cooling in terms of cfm/bird. The concept of using a ratio of air moving capacity to the number of birds in the house was borrowed from research studies examining air exchange rates. By using a ratio, producers could calculate how much fresh air had to be introduced in order to minimize the buildup of heat during summer and moisture during the winter depending upon the density of birds in the house.

The use of a ratio of cfm to number of birds has not been totally unsatisfactory in determining the number of circulation fans required for a broiler house. But is there a better way? Should we be using a concept that was devised to determine air exchange rates, not air circulation requirements? After all, the cfm/bird ratio doesn't take into account factors such as fan type and flow characteristics.

In order to determine the best way to install circulation fans in a broiler house, it is important to understand what we are trying to accomplish with their use. Birds are always trying to rid their bodies of excess heat. Heat is a waste product of metabolism, digestion, and bird activity. At low ambient temperatures, the difference between the bird's body temperature and its surroundings is large enough that eliminating excess heat does not present the bird with a significant problem. As air temperature increases, it becomes more and more difficult for the bird to rid itself of this excess heat. For example, a hot bowl of soup will cool off much faster in a refrigerator than in a 90°F room.

In order to survive, the bird will try to increase heat loss as well as decrease heat production. Birds will begin to pant to increase the amount of heat loss by evaporating moisture off their respiratory system. They will move their wings away from their bodies

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in an effort to increase cooling by air movement. They will decrease feed consumption to minimize the amount of heat produced through digestion. If the bird cannot rid itself of this excess heat, it will die.

One way to help remove heat from the birds is through air movement. As air moves over a bird's body it picks up heat. The faster the air moves, the more heat is removed from the bird. If a sufficient velocity of air is moved over their bodies, enough heat will be removed that the birds can continue to eat and grow (Figure 1). However, in order to maintain production throughout the house it is essential that every bird is exposed to adequate air movement over its body. In those places where the birds don't receive adequate air movement, they may die. This is why birds in dead air spots, such as in the corners of the building, are often the first to die.

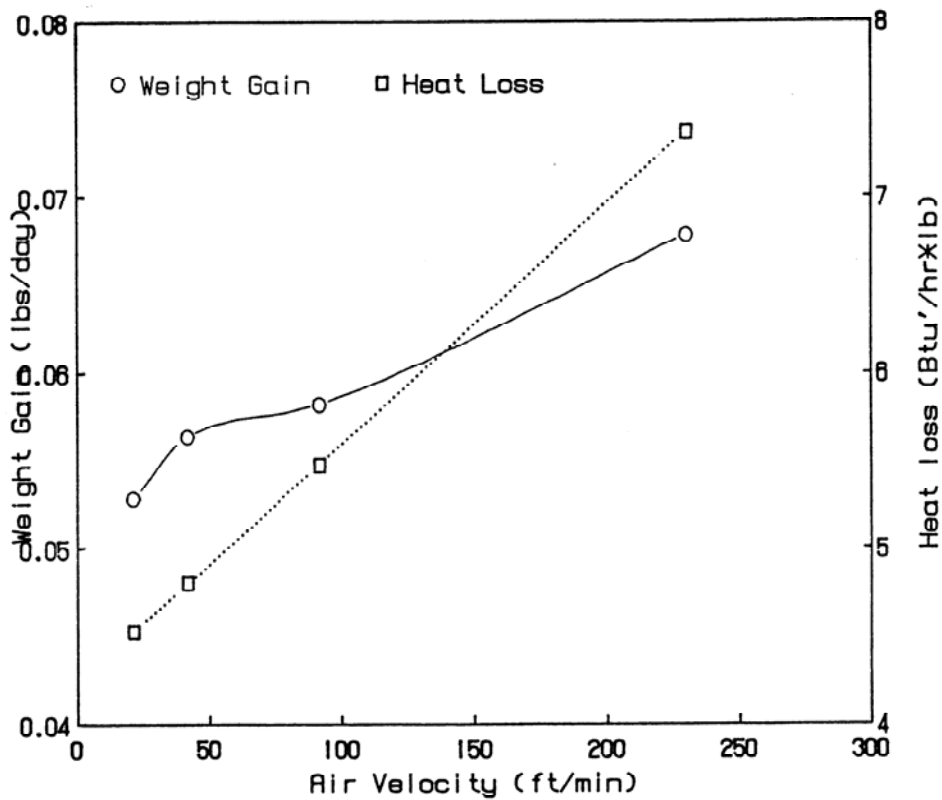


Figure 1. The Effect of Air Velocity on Poultry

The second factor that must be taken into account when looking at circulation fan placement is that a fan will only effectively move air over an area of specific

dimensions. The shape and size of the coverage area are determined by the type of fan. Air emanating from a standard 36" circulation fan with 1/2 hp motor travels in an egg-shaped pattern. The dimension of this area is approximately 50' x 20' (Figure 2). A "Casablanca" type ceiling fan on the other hand moves air downward and then across the birds (Figure 3). As a result, the coverage area is circular in shape and approximately 40' in diameter.

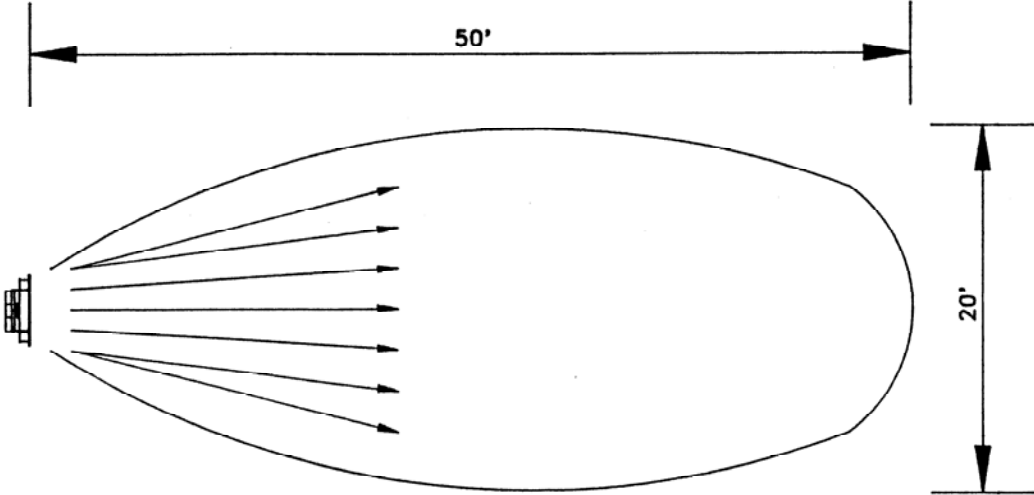


Figure 2. 36" Fan Coverage Area

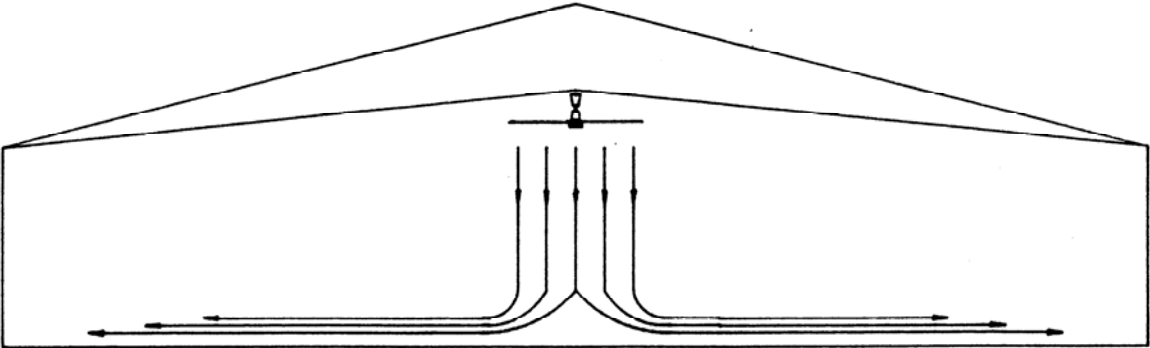


Figure 3. Ceiling Fan Coverage

It really doesn't matter how many birds are in the house or even how many square feet are in the house. What does matter is the shape of the house and how it relates to the circulation fan's coverage area. For instance, a 350' x 40' house would require

fourteen, 36" fans (Figure 4) or nine Casablanca type fans to provide uniform air movement (Figure 5). The same number would be required for a 350' x 34'. The narrower house would have more air movement, but there would be no practical way to reduce the number of fans and still provide good air movement throughout the entire house. As you can see, in order to assure complete air movement in the house it takes a large number of fans. If you reduce the number of fans, there will be dead spots in the house (Figure 6).

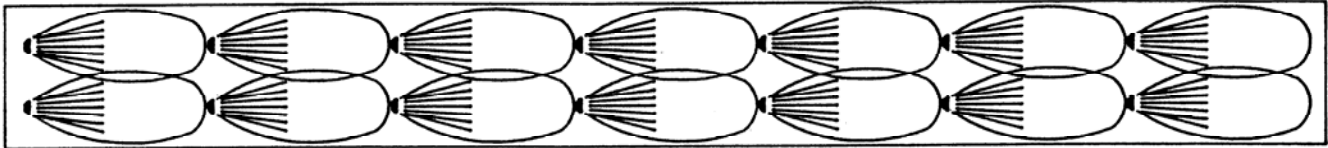


Figure 4. Circulation Fan Placement for Total Coverage

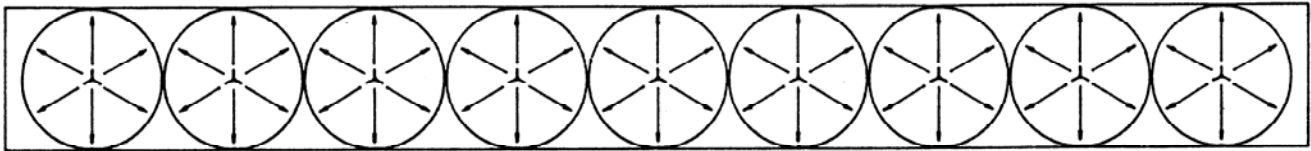


Figure 5. Casablanca-Type Fan Placement for Total Coverage

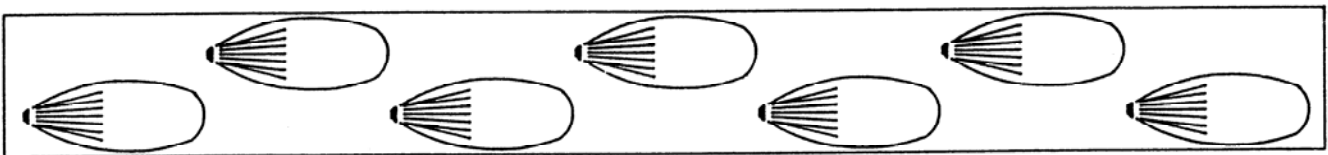


Figure 6. Circulation Fan Placement with "Dead Spots"

Due to the large number of fans required for total floor coverage many producers have gone to a tunnel ventilation system. Tunnel ventilation establishes a positive, more uniform, air flow pattern throughout the house. In a tunnel-ventilated house, all exhaust fans are installed at one end of the house. During hot weather, both sidewall curtains and end doors at the fan end are closed. The end doors at the opposite end of the

drawn through these openings and then down the house in wall-like fashion at more than 4 mph. This provides a substantial wind chill effect for the birds throughout the house (Figure 7).

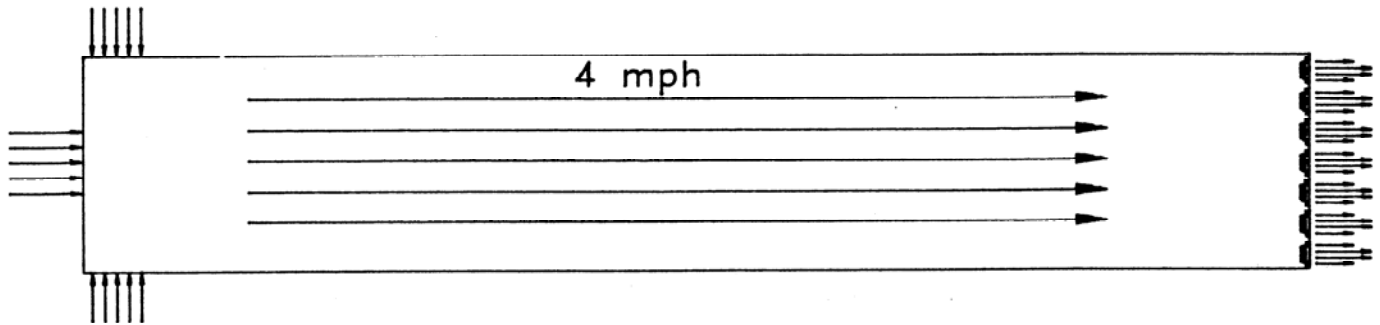


Figure 7. Tunnel Ventilation

Total coverage of the floor space with circulation fans may not be necessary in all instances. In many locations, such as coastal areas and mountain ridges, breezes are prevalent enough that additional air movement in the center of the houses is all that is required. In these houses, a single row of fans (on 50' centers) can be installed down the middle of the house. Fans should be paired in those areas where heat buildup tends to be more of a problem, such as the ends and the center of the house (Figure 8).

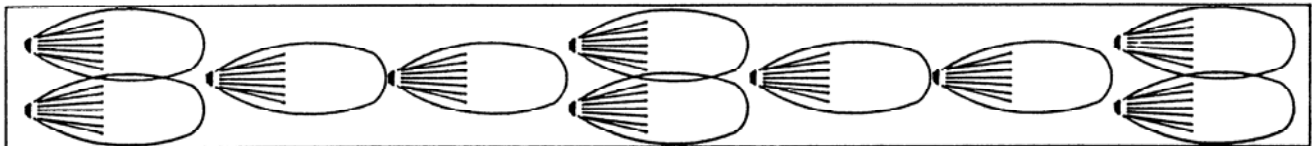


Figure 8. Fan Placement in Areas With a Prevalent Breeze

No matter how circulation fans are placed in a curtain-sided house, there is no way to get around the fact that it is a curtain-sided house. Air exchange and movement, for the most part, are random. As a result, the environment and therefore production will likely not be comparable to a tunnel-ventilated broiler house during hot weather.

The following are some general rules to consider when installing circulation fans:

- 1) Move exhaust fans off the sidewalls--otherwise birds will tend to move toward the fans and pile under the fan or against the sidewall.
- 2) Install fans so they are approximately 4' off the floor. Place the fans on winches so their height can be adjusted.
- 3) Tilt fans down slightly to increase the amount of air movement over the birds.
- 4) Fans should blow with the prevailing wind to increase the area covered by each fan.
- 5) Avoid positioning fans such that there is a zone of extremely high air movement directly in front of a fan. Birds will sense the high air velocity and may crowd.
- 6) Always position fans so that there is air movement in the ends of the house. Smaller fans can be used in the corners to minimize dead spots.

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