Department of Poultry Science
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Poultry Housing Tips

Basic Circulation Fan System Design

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Figure 1. Circulation fan system in a 60' X 600' house

A properly designed circulation fan system can provide a grower with a variety of benefits. During cold weather, circulation fans can transfer hot air collecting near the ceiling to bird level, increasing floor temperatures and decreasing heating costs. Circulation fans can also help move warm air from the center of a house towards the cooler areas near the side and end walls, thereby improving house temperature uniformity and again potentially lowering heating costs. Last but not least, a well-designed circulation fan system can increase air movement at floor level resulting in drier litter, lower ammonia levels, and overall improved bird performance and health.

As is the case with a tunnel ventilation system design, there is more to designing an effective circulation fan system than scattering a few nondescript circulation fans around a house. For instance, a tunnel ventilation system needs to be able to exchange a specific amount of air each minute. Likewise, a circulation fan system needs to be able to mix a specific volume of air each minute. A tunnel ventilation system requires tunnel fans that have a number of important characteristics (i.e., discharge cone, 54"+ diameter air moving capacity). Likewise, a circulation fan system requires fans that meet a number of equally important characteristics (i.e., size, air moving capacity, construction, wide guard spacing). Both systems require the fans to be installed in a specific area of a house and in a specific fashion in order to generate the desired air flow pattern within the house. Finally, as is the case with a tunnel ventilation system, a circulation fan system needs to be designed to be able to generate a specific air velocity at floor level if benefits are to be maximized.

Figure 2. Circulation fan positioned at the ceiling and held so that it blows air parallel to the ceiling.

Numerous field studies conducted by the UGA Poultry Science Department have documented that circulation fan system benefits appear to be maximized if it can move least 20% of a house's volume each minute. For example, a 40' X 500' house with an average ceiling height of 9 ½' has a volume of 190,000 cubic feet. To be able to mix 20% of the house volume each minute, a circulation fan system should be capable of moving at least 38,000 cubic feet of air each minute. For a 60' X 600' house with an average ceiling height of 9 ½' (342,000 cubic feet) a circulation fan system should be capable of circulating at least 68,400 cubic feet of air each minute (Figure 1). The required number of circulation fans can be calculated by dividing the total circulation fan system capacity by the air moving

capacity of an individual circulation fan at a static pressure of 0.00". For instance, if a circulation fan moves 5,600 cfm @ 0.00", at least seven would be required in the 40' X 500' house and at least 12 in the 60' X 600' house.

For most houses, the most appropriate circulation fan is a 24", 1/3 hp fan that moves approximately 6,000 cfm (Figure 2). The fan should have an orifice around the prop which helps to produce a narrower air jet which maximizes the distance the fan will move air along the ceiling. In addition, a narrow jet of air moving along the ceiling at the center of a house helps to create a return air flow pattern along the side walls and floor (Figure 3). To minimize power usage, circulation fans should have an energy efficiency rating of 16 cfm/watt or greater.

Circulation fans should generally be evenly spaced along the center line of a house, within few inches of the ceiling, directed to blow air towards the end walls of the house. The circulation fans should be installed so that they are held in a position where they are blowing air parallel to the ceiling and prevented from blowing air towards the floor. In most circumstances, circulation fans will need to be installed between 40' to 60' on center.

It is generally recommended against installing circulation fans in a "racetrack" pattern where the fans are installed in two rows, positioned near the side walls, blowing air in opposite directions. Positioning circulation fans near the side walls tends to create excessive air movement near the side walls, potentially creating drafty conditions for the birds near the side walls. In addition, generating excessive air movement near the side wall disrupts inlet air flow patterns, thus preventing the cool incoming air to be fully warmed before moving down to floor level. Last but not least, placing circulation fans near the side may not result in the hot air collecting near the ceiling peak being fully mixed with the rest of the air in the house.

In houses utilizing partial house brooding, the circulation fans in the brooding area should be installed so that half the circulation fans are directed to blow air towards the end wall and the other half towards the brooding curtain. The circulation fans that are near the center of the brooding area, blowing in opposite directions, should be positioned approximately 20' apart (Figure 4). Ideally, circulation fans would be positioned within 40' of the end wall and brooding curtain.

On the nonbrooding end all the circulation fans should be directed to blow air toward the nonbrooding/tunnel fan endwall. The first circulation fan should be positioned within 20' of the brooding curtain to encourage the movement of warm air from the brooding end to the nonbrooding end of the house.

The goal when designing a circulation fan system is to create a continuous high-velocity air stream along the peak of the ceiling moving air from the center of the house to the ends where it reverses direction and moves back towards the center of the house along the side walls and the floor at much lower velocity (100 - 150 ft/min). By creating a "whole house" circulation pattern, variations in house temperature and air quality tend to be minimized. In addition, the air movement over the litter created by a well designed circulation fan system will lead to drier litter, reduced ammonia levels, and in turn an overall improvement in bird performance and health.

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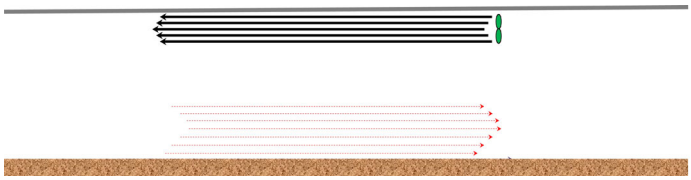

Figure 3. Return air flow along the floor

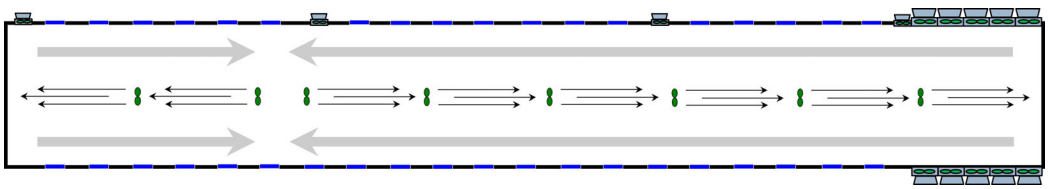

Figure 4. Circulation fan system house air flow pattern