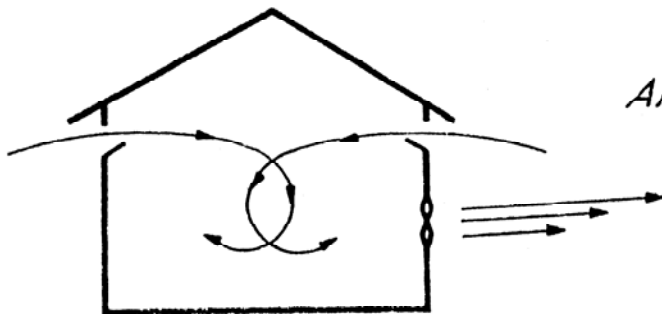




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AIR INLETS & FAN PERFORMANCE

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EXTENSION ENGINEER

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The modification of many of our traditional curtain-sided poultry houses to tunnel ventilation has left the owners of these houses with a significant increase in the number of exhaust fans which they can use throughout the year. This increase in exhaust fan capability has led to many questions, one of which is, "How many fans can I run pulling air only through my existing sidewall inlets?". In order to answer this question it is important to understand the relationship between inlet area and fan performance.

In order for an exhaust fan to operate efficiently it is very important that the proper amount of inlet area is provided. If there is not enough inlet the fan will strain and performance will be decreased. This decrease in performance can result in fan capacity being reduced by 30 percent or more.

The strain placed on an exhaust fan can be compared with the strain placed on you when you try to sip your coffee through a small coffee straw. The faster you try to drink your coffee the harder it becomes. No matter how hard you try, you're just not going to finish the cup very fast. But, if you were to use larger straw, you could drink your coffee faster and with greater ease. The same holds true for your exhaust fans. If fans are forced to pull air through too small of an opening, it will take a long time to exchange stale house with fresh outside air. A lot of power will be used in the process also.

The problem lies in the fact that there is a limit as to how fast you can pull air through an opening. The faster you try to pull air through an inlet the more force required. Eventually the strain placed on the fans by pulling the air faster and faster through the inlets results in a decrease in fan performance.

How fast air moves through the inlets is determined by the amount of inlet available to the fans. The smaller the inlet opening the faster the air will travel through the inlet. Too small an inlet opening is available for a fan or group of fans leads to high air velocities and the aforementioned decrease in fan performance.

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.

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In general, exhaust fans have little difficulty in pulling air into a house if the velocity of the air traveling through the sidewall inlets is kept below 900 feet per minute (10 mph). Any attempt to bring the air in faster than 900 feet per minute will be met with a dramatic decrease in fan performance. This maximum allowable inlet velocity changes according to the type of inlet. For a light trap in a dark out pullet house or for the main openings in a tunnel-ventilated house, air speed should not exceed 500 ft./min. If you are pulling air through a 4" evaporative cooling pad, air velocity should be kept below 300 ft./min. (much more resistance to flow).

To calculate how much inlet is required for a specific house the following equation can be used:

$$\text{Total inlet area (square feet)} = \frac{\text{Total Fan Capacity (cfm)}}{\text{Maximum Inlet Velocity (ft./min.)}}$$

To determine how many fans can be run before having an adverse effect on fan performance the following equation can be used:

$$\text{Maximum \# of Fans} = \frac{\text{Inlet area (ft}^2\text{) X Maximum Inlet Velocity (ft./min.)}}{\text{Individual Fan Capacity (cfm)}}$$

Example: How many 48" exhaust fans can be efficiently operated through the inlets of a poultry house with fifty two, 44" X 3 1/2" inlets?

$$\text{Inlet Area} = 44" \times 3 \frac{1}{2}" = 1.1 \text{ ft}^2 \text{ per inlet}$$

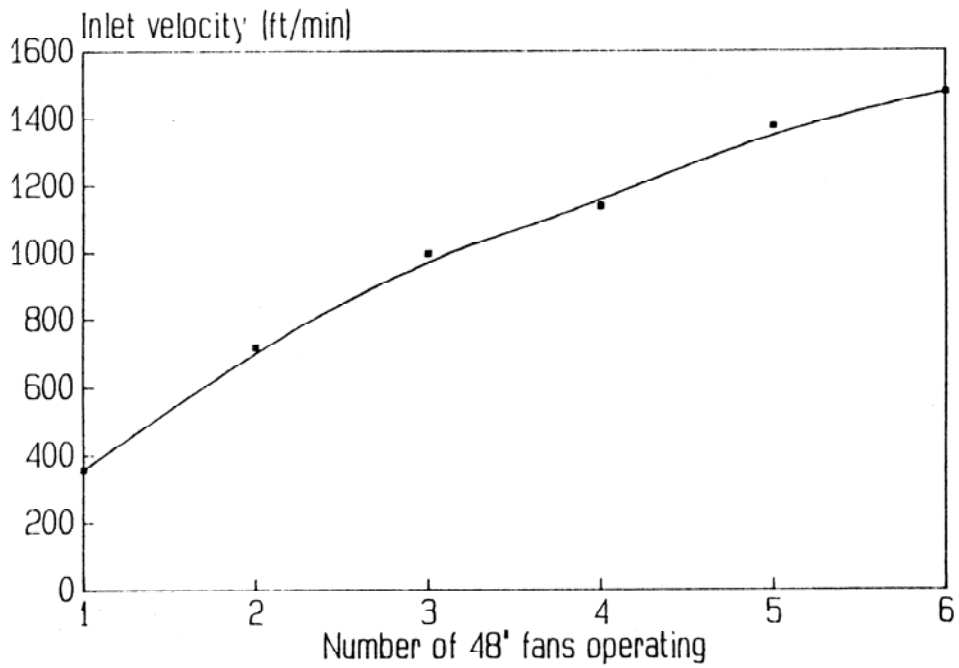
$$\begin{aligned} \text{Total Inlet Area} &= 1.1 \text{ ft}^2 \times 52 \\ &= 57.2 \text{ ft}^2 \end{aligned}$$

$$\text{Individual fan capacity of a 48" fan} = 20,000 \text{ cfm (approximate)}$$

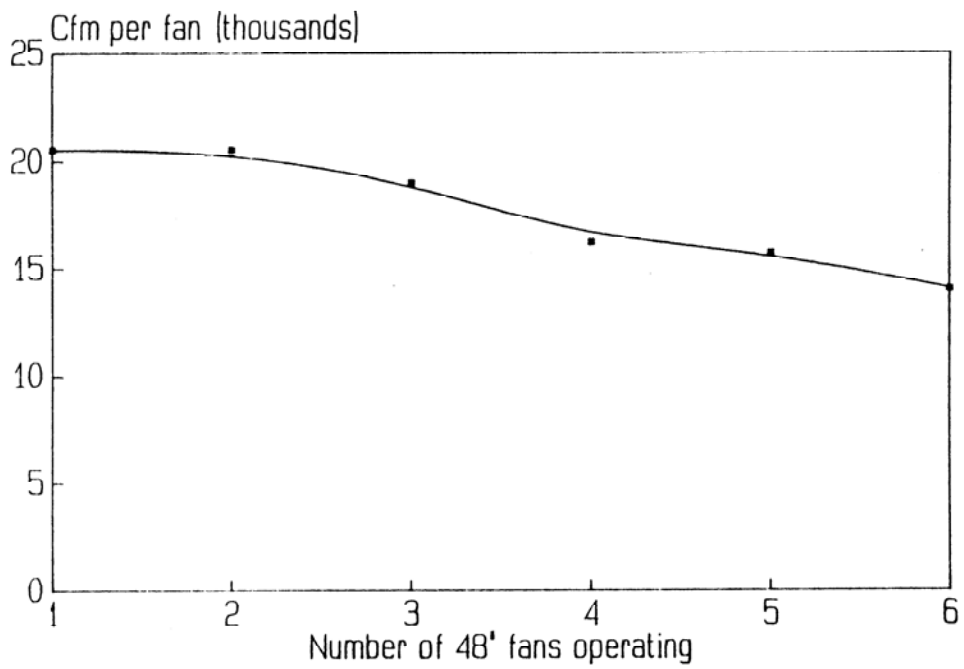
$$\text{Maximum Number of Fans} = \frac{57.2 \text{ ft}^2 \times 900 \text{ ft./min.}}{20,000}$$

$$= 2.5 \text{ fans (between 2 and 3 fans)}$$

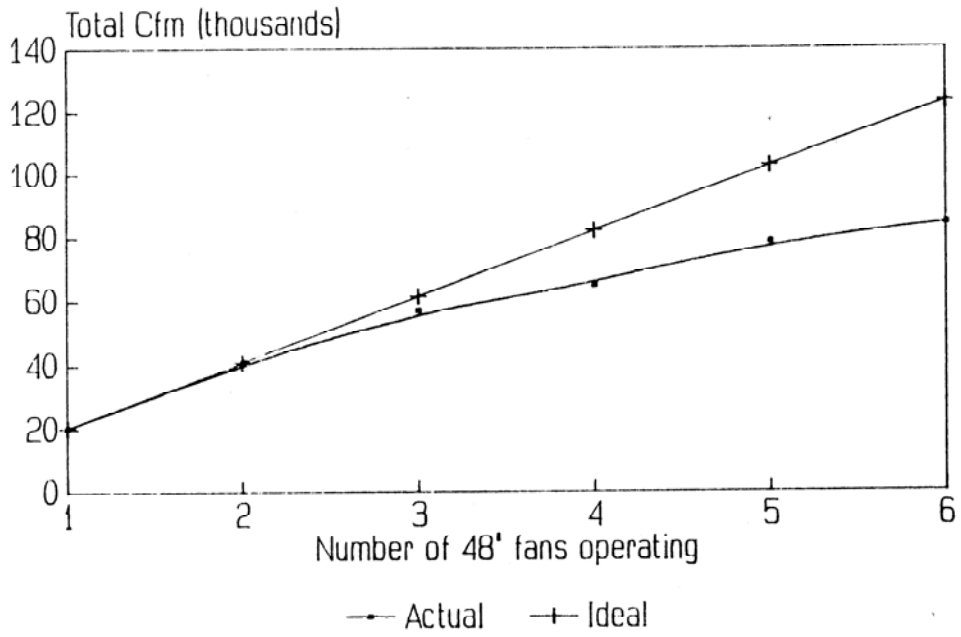
The result of turning on more 48" fans can be seen in the following graphs. As more fans are turned on, the speed of the air moving through the inlets increases beyond 900 ft./min. (graph #1). The additional strain placed on the fans decreases the amount of air moved by each fan (graph #2). The final result, six 48" fans are required to move 80,000 cfm, a job that four fans would be able to handle if there were more inlets (graph #3).



Graph 1



Graph 2



Graph 3

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