Tube Fan Ventilation for Pre-Weaned Calf Barns

Part 2: Fan Considerations

While fans all preform the basic function of moving air form one space to another, they are designed for a wide range of applications. For an application to work as intended the fan and system must be compatible from both a performance and design standpoint. Selecting a fan requires the consideration of various characteristics such as fan type, flow control, and output. This fact sheet outlines several of the major considerations relating to fan type, rating parameters, and design.

Fan Output

A primary consideration should be the fan's rated ventilation capacity expressed in cubic feet of air moved per minute (CFM). The fan's capacity to move air determines the diameter of the attached tube, as well as the spacing, size and location of holes punctured in the tube. Given the significance, the fan's output should meet the design requirements listed in a tube fan ventilation system design.

Ventilation fans exchange air from a given space, and in doing so they work against static pressure (sp) which is generally expressed by inches of water column (wc), measured with a manometer. The amount of air a fan can move is dependent on static pressure, and therefore should be considered when comparing rates. Static pressure is increased by the amount of resistance to flow the air must overcome. Total ventilation system static pressures normally vary from 0.08 to 0.20 inches of water depending on the system design [1].

Performance Data

When selecting a ventilation fan to meet a design specification, it is recommended to choose fans based on performance data developed by an independent third party. BESS Lab, at the University of Illinois has tested many fans, thus providing a reliable third-party source of independent data. A listing of all the fans tested can be found at: http://bess.illinois.edu.

Fan Type

The type of fan is a central consideration to choosing which fan will meet the tube fan ventilation system's design specifications. Overall two general types of ventilation fans are available for agricultural use: circulating/ panel fans and exhaust fans.

Exhaust fans (Figure 1) are typically used for air exchange and panel fans (Figure 2) are mostly used to move air within a space. Although, there is some overlap in how these fans can be utilized. Either type of fan can be specified for a tube fan ventilation system depending on the application and design. However, keep in mind that the fans are primarily designed for differing purposes, causing their performance to be tested and measured differently. Exhaust fans are designed to work against static pressure, and are fitted with a deeper housing, back-draft shutter and discharge cone; often making them the preferred fan type for tube fan ventilation designs. Panel fans are commonly used for cooling cattle versus ventilation. Without the same fittings and design, the fan has less ability to overcome static pressure.

Figure 1.
Exhaust Fan [2]

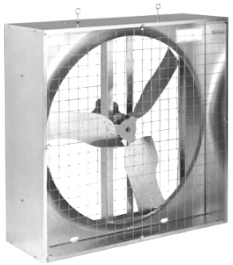

Figure 2.
Panel Fan [2]

Fan Drive

Fans can be reduced into two basic drive types; belt and direct drive. In most cases, direct-drive fans are preferred because the desired performance is more easily maintained over extended use periods than belt-driven fans. Direct drive fans are also economical for low volume, they require little maintenance and most direct drive motors can be used with a speed control to adjust output. Belt-drive fans have excellent airflow capacities and operate with comparatively little noise when first installed. However, their performance falls off with time as the belts wear.

Variable Speed Fans

Fans can be sold with variable speed drives. A tube fan ventilation design will occasionally specify a variable speed fan to run at less than full capacity to provide draft-free air streams to the calf in colder seasons. Otherwise, variable speed fans are not generally purchased for tube fan systems. Each tube in the system is individually designed for a specific fans capacity to match a season's calculated air exchange rates. A single tube should not be used for multiple seasons by adjusting the fan speed.

Power Phasing

Fan motors can be single-phase and three-phase power. When the facility has three-phase service it is typical to choose a three-phase fan, as three-phase motors last longer and are generally more efficient than single phase motors. Although, single-phase fans can also be used when the service is three-phase.

System Considerations

Colder climates that receive snowfall should consider a method to stop snow and chilled air from entering warm-season tube fans. All non-stage 1 fans are required to have a shutter in neutral ventilation systems to provide an air tight environment. In solely positive pressure systems the shutter should be used in the same manner to prevent wind and snow from entering the tube.

For easy installation of the system, the fan's diameter should not exceed that of the tube, due to the need to attach the tube to the fan's discharge. Typically, the tube is attached to the fan's discharge cone which has a diameter greater than that of the fan. When this cannot be avoided, a transition piece will need to be fabricated to connect the fan to the tube.

Controllers

Fans are best controlled by an automated system rather than by manual controls. For example, a dedicated fan controller or an overall barn environmental management controller. Automated controllers with proper settings selected will provide the correct amount of air exchange given the current temperature in the facility by automatically turning more stages on with an increase in temperature and shutting them down when the temperature decreases. Since the East, especially the Northeast, is subject to significant swings in temperatures over short periods of time, it is important to utilize a controller that automates the system, to ultimately have well-managed calf barn ventilation.

FACT SHEET SERIES
Tube Fan Ventilation for Pre-WEANED Calf Barns
Part 1: System Overview and Practical Information
Part 2: Fan Considerations
Part 3: Tube Options Overview
Part 4: What is needed to Design a Tube Fan System for Existing Barns?

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[2] Munters Aerotech. (2013) images. https://www.munters.com/en/