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Poultry
Fact Sheet

VENTILATION BASICS FOR UTAH TURKEY FACILITIES

David D. Frame, DVM, Extension Poultry Specialist
USU Turkey Research Center, Ephraim, UT 84627
Gary L. Anderson, MS, Sanpete County Extension

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WHY VENTILATE?

One must remember that turkeys are living things and need adequate high quality air to breathe just as we do. The anatomic structure of the respiratory system in birds makes them very sensitive to air quality – particularly dust and ammonia levels. Conscientiously maintaining proper ventilation of turkey facilities will translate into greater profit as well as greater comfort to the caretaker.

The main reasons for ventilating are to:

- Maintain an adequate supply of oxygen
- Remove harmful gases, such as carbon monoxide, carbon dioxide, and ammonia
- Control moisture accumulation in the building (i.e., humidity)
- Control temperature
- Remove dust and dander particles

The provision of adequate oxygen and removal of carbon monoxide and carbon dioxide are the most important considerations in brooder buildings. Priority in growouts should first be placed on moisture removal, then ammonia removal, and last on temperature control.

VENTILATION CONCEPTS

"Natural" vs "power" ventilation. Natural ventilation is nothing more than relying on local environmental wind conditions to move air through a building. This is accomplished by using side curtains and/or end doors that can be opened and closed as needed. The advantages of using natural ventilation in our area are 1) a large quantity of air can be moved through a building in a short period of time and 2) no electrical power is needed to move the air. Disadvantages consist of 1) control of how much air moves through the building is difficult; 2) temperature inside the building is impossible to regulate adequately; 3) wind speed, temperature, and direction can change so rapidly that it is impossible to keep an optimal flow of air going through the building at all times; and 4) natural ventilation is only good if the inside/outside temperature differential is less than 10º to 15º F. Most turkey buildings are 50-60 ft wide. Forty to 50 ft. buildings are best for natural ventilation. Sixty-ft. wide building is the threshold. Natural ventilation is most inefficient in 60 plus ft. wide buildings.

Power ventilation consists of using fans to physically move air into or out of a building. Generally speaking, removing air by means of exhaust fans is the most efficient way to ventilate. These fans are positioned in the sidewalls or endwalls while incoming air enters through cracks

in construction, through curtains, or through vent boxes. The advantages of power ventilation are 1) a consistent quantity of air can be moved through the building within a specified period (this is measured in cubic feet per minute, or cfm), 2) ventilation rate can be electronically modified to minimize humidity and temperature fluctuations, and 3) the locations that incoming air enters can be controlled by properly positioning air inlets.

Air exchange vs air movement. These terms mean very different things. *Air exchange* is the movement of inside air to the outside and outside air to the inside of the turkey facility. Air exchange rate is expressed in changes of air per minute, or in cfm/turkey. *Air movement* is the process of relocating air to a different place within the building by using circulation fans. It is possible to have very strong air movement but no air exchange. Both of these processes are important in maintaining optimal ventilation.

Cold and warm air dynamics. Cold air is heavier than warm, and will sink to the floor of the turkey building. Notice that on cold days the litter directly below the curtain is much cooler than in other areas of the building. Turkeys have a tendency to avoid these cooler sidewalls. The lower the air temperature, the more dense it becomes. Cold air cannot hold as much water vapor as warm air. This is partly why in growouts with inadequate nighttime temperature regulation the litter becomes mucky and the building "sweats." A good rule of thumb is that for every 20^{o} F rise in temperature, the water-holding capacity of air doubles. This phenomenon is what makes it possible to dry out a building by using power ventilation, particularly during winter.

Static pressure. The slight negative pressure created in the turkey building when exhaust fans turn on is known as *static pressure*. It is this suction that pulls air into the building through cracks, crevices, and curtains. Static pressure is measured with a manometer, and is expressed in inches of water column (wc). The greater the static pressure (or "pull" by the exhaust fans), the greater will be the velocity of incoming air. As the air shoots into the building, it mixes with the air already inside. A rule of thumb is that each 0.05" of static pressure will shoot air out about 12 feet. Static pressure in turkey buildings should be maintained between 0.03" and 0.10" wc. Keep in mind that static pressure does not necessarily relate to the *volume* of air entering a building, but only to the *velocity* at which a given quantity of air is moving through the inlets.

Fans. Fan output is rated in cfm. The following table lists approximate range of output according to fan size working within a static pressure of 0.05" to 0.08" wc. Keep in mind that specific makes and models of fans may vary considerably according to blade pitch and other structural factors.

Fan diameter	Range of cfm production
18"	1,500 to 2,000
24"	3,000 to 5,000
36"	8,000 to 10,000
48"	18,000 to 20,000

VENTILATION TIPS

- Air must be controlled as it enters the building. This is best achieved by mounting rectangular vent boxes along the upper part of sidewalls that automatically adjust to variations in negative pressure. Proper installation of vent boxes will direct the incoming air slightly upwards where it will mix with warmer air and gently fall to bird level.

● Consider using a five minute fan cycle rather than ten. Temperature and moisture levels will not fluctuate as severely.

● Keep inlets, fans, and shutters clean. We have demonstrated that simply brushing off the dust accumulation on fan blades, guards, and shutters increases fan efficiency 12% to 15%.

● Adjust building inlet area to number of cfm being moved by the fans. Static pressure should optimally be maintained between 0.05" and 0.08" wc. This may require sealing cracks and crevices to reduce amount of air entering the facility. Sealing these extraneous sources of leakage will also help keep incoming air entering through areas where you want it to come in. As a rule of thumb, one 2.41 to 2.44 ft^2 vent box opening will accommodate 1500 cfm of fan capacity.

● Minimum air exchange rate in a brooder with newly placed poults is 0.2 cfm/poult. The maintenance of adequate static pressure in order to achieve proper direction and speed of incoming air is especially important in the brooder. Outside air must be tempered by mixing with the warmer air inside before reaching poult level. Inadequate static pressure will cause the cool incoming air to sink and migrate along the floor, thereby chilling the turkeys even though the brooder thermometer mounted at eye level may read in the comfort range.

● If brooder house temperature is stable and comfortable, especially from 1 to 7 days of age, wire brooder guards offer better ventilation than cardboard guards. Carbon dioxide levels rapidly build up within these cardboard shields. Young turkeys are very sensitive to high levels of carbon dioxide gas. If exposed to a high concentration of carbon dioxide for very long, poults will become sleepy resulting in inadequate feed and water intake.

● One complete air change should occur in turkey growouts *at least* every 3 to 5 minutes. This air exchange rate will need to be even greater (i.e., every 1 to 2 minutes) during the summer months. Plan fan capacity to accommodate this need.

● Use power ventilation in growouts to first control moisture, then ammonia, and last, temperature. Many growers have a tendency to reverse the order of these priorities. It is important to keep in mind that temperature during power ventilation can be stabilized by using additional heat. However, moisture and ammonia can only be controlled by sufficient air exchange rate (i.e., ventilation!). Leg problems and airsacculitis caused by wet litter and ammonia are much more economically devastating than a slightly higher heat bill.

Understanding the concepts of why and how to ventilate will allow you to harness this powerful tool to increase profitability.

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