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The Importance of Proper Ventilation for Small Poultry Flocks

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Using the calculations in this publication will help ensure proper ventilation for health and well-being of small poultry flocks.

Proper ventilation is essential in poultry operations. Important environmental challenges include weather extremes and rapidly changing weather conditions. Colder months can mean difficulty in providing adequate ventilation while trying to maintain a comfortable temperature within the chicken house. Hot weather can mean difficulty in providing enough ventilation for heat to escape the house. Whether the temperature is hot or cold, it is important to supply the flock with adequate ventilation to bring in fresh air and exhaust carbon dioxide.

The primary purpose of having a ventilation system is to provide for air exchange. Ventilation is needed to remove excess heat, dust particles and moisture produced during normal activities — such as metabolism, respiration and evaporation — as well as harmful gases and disease-causing organisms that may be present. A ventilation system should provide fresh, oxygen-rich air for birds, which promotes optimal production.

Second, a good ventilation system should distribute air uniformly throughout the building. The house should not have "dead air zones."

Third, the ventilation system should control airspeeds within the room. During cold weather, entering air may need to have adequate speed to accomplish proper mixing and distribution, but the air speed must be controlled so as to not create drafts on the birds. During warmer weather, air movement minimizes temperature increases within the bird space. While accomplishing these essential functions, ventilation systems also need to be easy to operate and maintain.

During cold weather, producers often close up their chicken houses in an attempt to maintain higher inside temperatures, which usually results in only a small temperature rise. Improper ventilation will result in increased humidity and possibly condensation and a buildup of carbon dioxide, ammonia and odor. Viruses and other respiratory pathogens that may be present will find these conditions well-suited for their growth and ready transmission to other birds sharing a common airspace.

Moisture accumulation occurs as a result of a lack of fresh air to remove moisture produced by animals. Humid air is more prone to condense on cold surfaces, which can lead to wet litter and equipment failures. Minimize condensation by keeping the relative humidity of the poultry house at 70 percent or lower and by insulating areas such as the ceiling. A buildup of carbon dioxide and ammonia will result in poor overall flock health and potential death. Pathogen buildup often is overlooked because it is difficult to assess directly. However, this probably is the greatest risk for producers because by the time infection thresholds are exceeded and disease symptoms are noticed, the entire flock already will be infected.

Natural Ventilation Systems

The best way to prevent adverse effects of inadequate ventilation is to take steps to ensure the birds always are provided fresh air. The simplest way to provide fresh air is to use the natural ventilation systems that already may be built into the chicken house. Natural ventilation takes advantage of basic principles of warm, humid air wanting to rise and wind producing pressures on building surfaces. Natural ventilation uses windows, panels and low hanging doors to allow in fresh air, all of which are most effective when located on all four corners of the housing facility.

Determinations for how far to open windows and doors can be made on the basis of air temperature, prevailing wind direction, age of birds, amount of moisture and the level of gaseous buildup within the house. It is important to place and orient the chicken house properly to take advantage of prevailing winds. Warm-weather openings need to be exposed to prevailing winds, which in Nebraska generally means the ridge should run east and west. The house should be situated away from any windbreaks, buildings or other obstacles that might impede natural air flow, and with no upwind obstructions desired to the south or southeast (direction most warm fronts travel in Nebraska). In addition to windows and doors, roof ventilators can be used, but require more practice and monitoring to be effective. When placing openings, consider that poultry, especially chicks, do not tolerate direct drafts of cool air.

Natural ventilation usually is the cheapest and simplest method that can be used to provide birds with the fresh air they need. Modern poultry houses with natural ventilation often include control systems that automatically adjust the size of openings using fully adjustable curtains, panels, baffles, etc. This increases the initial cost, but may be worthwhile for the

producer who finds monitoring and controlling the environment manually an overly daunting task and can justify the investment with improved health and performance.

Mechanical Ventilation

Forced ventilation is an alternative to natural ventilation. Also referred to as mechanical ventilation, forced ventilation uses a combination of electric fans, air inlets and controls (thermostats, timers, etc.) to regulate temperature and humidity. The primary advantage of forced ventilation is that the producer has reasonably direct control over the rate of airflow delivered. Moderating indoor temperature swings often is a major goal of producers who select these systems. Having a controlled system eliminates much of the guesswork, as one can — at least in theory — simply set the controls to the desired temperature and let the machines do the rest of the work. This type of system has its disadvantages, though, as cost can be a prohibitive factor. Mechanical ventilation systems generally require greater initial investment in equipment, require regular maintenance to perform properly, and have a higher cost of operation in terms of energy usage. Dependable emergency backup is necessary in case of power failure.

Ventilation systems usually are designed for a specific house, based on the number and size of birds housed in the facility, as well as the volume in cubic feet of air in the house. Generally, a system should provide one air exchange per minute (60 per hour) or more during hot weather. The system also needs to be adjustable to maintain an airflow rate as low as 1 to 5 air exchanges per hour during cold weather. To calculate the volume of air that needs to be moved to produce one air exchange, use the following formula: Length x Width x Height (average) of the airspace. To obtain the airflow rate (fan capacity in cfm) needed for given indoor conditions, multiply the air exchange volume (cubic feet) by the number of air exchanges recommended per minute for those conditions. The result can then be used to determine the number and size of fans that need to be operating, as well as the total inlet area needed.

As an example, consider a broiler house that is 30 feet wide, 60 feet long, and 8 feet tall at the sidewalls, with a pitched roof and no ceiling. Assuming the peak is about 12 feet tall, the air exchange volume is:

1 air exchange = 30 ft. x 60 ft. (8 ft. + 1/2 x 12 ft.) = 18,000 cubic ft.

For a hot-weather ventilation rate of 1 air exchange per minute, the total fan capacity needed is:

(25,000 cubic ft./air exchange) x (1 air exchange/min.) = 25,000 cfm

Generally, this capacity would need to be provided by a number of fans of different sizes, so the ventilation rate could be staged down to lower airflow rates during cooler conditions. To obtain one air exchange per hour, as may be more appropriate for younger birds in cool weather, for example, the airflow needed is:

(25,000 cubic ft./air exchange) x (1 air exchange/60 min.) = 300 cfm

Both the fan capacity and inlet opening would need to be adjusted to maintain proper air exchange, distribution and airspeed at bird level. In practice, it may be challenging to provide such a small airflow rate and still have good distribution and airspeeds. If cold-weather ventilation (commonly called "minimum ventilation") is improperly designed or controlled, the operator often will be tempted to close up the building and/or shut off all the fans. This will be especially tempting when heating fuel costs are high, since ventilation generally is the largest source of heat loss in animal housing. In these situations, it is paramount that producers recall why ventilation is needed, ensure their ventilation systems are not overly restricted, and seek ways to improve the seasonal performance of their system.

Conclusions

Effectively ventilating poultry facilities cannot be stressed enough, whether using a natural or mechanical type of ventilation system. A simple method to test the adequacy of a ventilation system is to use your nose and eyes. If you smell strong ammonia or observe thick cobwebs, the ventilation system is inadequate. Poor ventilation can result in poor respiratory health indicated by coughing and sneezing birds, and a higher rate of Ascites syndrome related deaths in heavy meat birds. Providing fresh air with an adequate ventilation system and removing excess heat and moisture, gases and other air contaminants from your chicken house will help produce healthier and more productive chickens.

Resources

Vosterman's Ventilations, *www.refreshinglypowerful.com*
Sun-North Systems Ltd., *www.sunnorth.com*
JanAire Ventilation Systems, *www.janaire.com/poultry/*

To simplify technical terminology, trade names sometimes may be used. No endorsement of products is intended nor criticism implied of products not mentioned.

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