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Air Quality in Turkey Production

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Introduction

Air quality is an important management consideration with turkeys that are grown in large, modern, highly specialized buildings. The controlled environments in these buildings provide many advantages by controlling light and temperature, and allowing year–round production. But in the Midwestern United States the extreme external temperatures involved in winter time production require good management practices to economically provide a good house environment. In confinement housing air contaminants such as ammonia, dust, and microorganisms and their endotoxins can buildup.

The by-products of turkey production (heat, water, carbon dioxide and droppings) are added to the environment inside the barn. When turkey droppings decompose in the presence of moisture and heat, ammonia is released into the air. Dust particles of dried droppings, turkey feather and skin scales, and some feed become airborne. Gases such as ammonia and microorganisms including pathogenic bacteria and viruses may be associated with the dust particles. Spores of harmful fungi such as aspergillus fumigatus may also be present. Aspergillus may be introduced through poor quality feed or litter material. The interaction of these various contaminants with litter conditions and temperature is the major cause of poor air quality and the condition called, "Winter Tom Air Sacculitis."

In air sacculitis, the lungs and air sacs become plugged with fluid. High mortality is observed near market time. Affected toms will gasp for air and often appear to die suddenly. Additional losses to the producer can be incurred by condemnation of carcasses during processing.

What is good air quality

Air for turkeys should have *less* than 20 parts per million (ppm) ammonia and 5 milligrams per cubic meter (mg/m^3) dust at bird level. Dust levels of 8 mg/m^3 can be tolerated if the birds are not being stressed by ammonia, heat, or the presence of respiratory disease agents. Good air quality management practices require heating and ventilating systems that provide a balanced environment. Poor respiratory health is the consequence of not providing this balance. Humidity and temperature also have an impact on air quality by influencing the survival of some pathogens and the severity of some diseases. Ventilation is an important consideration for controlling heat and humidity.

Ammonia levels greater than 20 ppm can easily be detected by humans. Lower levels are more difficult to assess. Ammonia can be measured using air sampler kits which use colorimetric gas detector tubes or dositubes which use diffusion for air to enter detector tubes. Air is drawn through the detector tube by a hand held pump. A change in color in the tube gives the ammonia concentration. Dust levels are more difficult to measure easily and is mostly done on a research basis. Visually, barns appear dusty as dust levels begin to exceed 5 milligrams per cubic meter.

Air quality and health

With each breath, the turkey's respiratory tract is exposed to the environment inside a turkey barn. Poor environments normally don't cause disease directly but they do reduce the birds' defenses, making them more susceptible to existing viruses and pathogens.

The turkey's respiratory tract is normally equipped with defense mechanisms to prevent or limit infection by airborne disease agents and to remove inhaled particles and keep the airways clean. Thus, health is affected by the function of these defensive elements: the cilia, the mucus secretions and the presence of scavenging cells which consume bacteria.

Cilia are tiny hairlike structures in the trachea. Cilia are responsible for propelling the entrapped particles for disposal. Mucus is produced in the trachea. Mucus secretion and movement of cilia are well developed in birds. The consistency of the mucus produced is important for the efficiency of the ciliary activity. Cilia cannot function when the mucus is too thick.

Scavenging cells in the lungs actively scavenge inhaled particles and bacteria that gain entrance to the lower respiratory

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tract. These cells consume bacteria and kill them, thus preventing their further spread. In essence, it is the integrated function of cilia, mucus and scavenging cells that keeps the airways free of disease–producing organisms. The impairment of even one of these components permits an accumulation of disease agents in the respiratory tract and may result in disease.

Research on the respiratory tract of turkeys has shown that as little as 10 ppm ammonia will cause excessive mucus production and damage to the cilia. Research has also revealed that ammonia levels of 10 to 40 ppm reduced the clearance of E. coli from air sacs, lungs and tracheas in turkeys.

In the turkey barn, exposure to high levels of ammonia may occur toward the end of brooding or just after the poults are moved into the grower barn. These are times when litter moisture may be high and ventilation may be decreased to conserve heat. Then as the turkeys grow older, the litter dries and more dust is released into the air. With the respiratory tract damaged previously by ammonia exposure, the dust becomes lodged in the tract and infectious processes begin.

Heat

High temperatures cause distress in turkeys. One mechanism for coping with heat is panting. Panting facilitates the introduction of dust and pathogens into the air sacs. A second problem is respiratory alkalosis and subsequent metabolic problems which reduce the turkey's ability to respond to respiratory insult.

Strategies for Control

Ammonia levels can be reduced by drying the litter with heat and ventilation which increase production costs. Too much ventilation reduces humidity and results in increased dust particles from feed, feathers and dried droppings. So the challenge for the manager is to avoid too little ventilation which results in ammonia and too much ventilation which results in dust.

An understanding of the relationships among temperature, relative humidity, ventilation rate and litter condition is needed. As ammonia is released from the microbiological breakdown of droppings, removal of the droppings/litter with frequent clean out will help control ammonia levels. Ammonia release can be decreased by lowering the litter pH (making it more acidic) with the addition of chemical compounds. However the effect of these additions is often temporary and frequent addition may be needed. Lowering the litter moisture will slow microbiological activity and thus ammonia release.

Dust is often controlled by increasing the moisture level of the litter and increasing the humidity of the air. Relative humidity can be increased by lowering barn temperatures or adding moisture through periodic sprinkling of the barn space. Periodic flushing or purging of air as occurs in naturally ventilated ridge buildings may be of benefit. Over ventilation or warm barn temperatures will lower humidity and allow dust to become airborne. Keeping relative humidity in the range of 60-70% and litter moisture at 35-40% will keep dust levels suppressed.

Summary

The interaction of dust, ammonia and temperature in the turkey building cause Winter Tom Air Sacculitis. Maintaining cool barn temperatures in conjunction with *less* than 20 ppm ammonia and 5 milligrams per cubic centimeter dust prevents this syndrome. In addition, removal of used litter prior to the winter season and use of good quality bedding will help to decrease air sacculitis problems.

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