Poultry Patter

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POULTRY HOUSE VENTILATION

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Ventilation in a poultry house has many functions: (1) To supply the oxygen needs of the hen, (2) to remove the carbon dioxide expired by the bird, (3) to control the moisture in the house, (4) to regulate the temperature, and (5) to help control disease.

An average 4-pound Leghorn hen breathes about 40 times a minute, inhaling and exhaling about 0.019 cubic feet of air. Air that is inhaled should contain 21 percent oxygen. About 5 percent of this oxygen will be picked up by the blood stream leaving only 16 percent in the expired air. It has been determined that 6 percent oxygen is the death level for chickens. Assuming that each bird in the house has access to 10 cubic feet of air, it would take 26 hours to kill all the birds in an airtight house with no air exchange.

Exhaled air will contain approximately 5 percent carbon dioxide, while inhaled air should have practically none. It takes an atmosphere of 30 percent carbon dioxide to kill chickens. Since the decomposition of the manure left in the house also adds some carbon dioxide to the atmosphere, it would take an estimated 50 hours to cause death because of high carbon dioxide levels. But problems would be very critical long before death occurs. If the oxygen is to be maintained at 16 percent and the carbon dioxide at 6 percent, then 9 hours is the maximum time a house could be without ventilation.

Only 0.01927 cubic feet per minute (c.f.m.) per bird is needed to supply oxygen needs of a laying hen. In a house of 10,000 birds, this is only 192.7 c.f.m. of air exchange in the building. This is on a calculated basis, but since no ventilation system is 100 percent effective a safety factor must be added. We do not ventilate poultry houses just to supply oxygen and remove carbon dioxide. Remember airtight windowless houses could cause problems when there is power failure.

Moisture Removal

Ventilation must remove the moisture expired by the birds as well as evaporate a certain amount from the feces. A 4.1-pound Leghorn will consume about 0.27 pounds of feed a day and drink 0.648 pounds of water. The bird's respiratory system will expire 0.18 pounds of the water taken in and 0.297 pounds will be eliminated in the feces.

A flock of 10,000 birds will produce 360 gallons of water per day in the feces. No wonder it is difficult to maintain dry litter in our poultry houses in winter. In addition, the birds will add 216 gallons of water per day to the expired air. Elimination of moisture is the big job for the ventilation system.

The incoming air must be warmed to increase its water holding capacity. The water holding capacity of air at various temperatures and humidities is shown in the accompanying table. The one available heat source is body heat given off by each bird. A Leghorn hen at an environmental temperature of 55° F. will give off 36 B.t.u. of heat per hour. In a 10,000 bird house, 360,000 B.t.u. per hour are available from the birds to warm the incoming air.

Pounds of water a thousand cubic feet of air will hold at various temperatures and relative humidities

Air temperature ° F.	Relative humidity 90%	70%	50%
30	0.25	0.19	0.14
40	0.37	0.29	0.21
50	0.54	0.42	0.30
60	0.75	0.58	0.42
70	1.04	0.81	0.58

Heat loss from a poultry house is one of the first factors that must be considered. It is impossible to maintain good environmental conditions in Minnesota without 4 - 6 inches of commercial insulation in the ceiling and 3 - 4 inches in the walls. All windows must have storm windows with an airspace between them. There is no substitute for insulation. An inadequately insulated house is bound to give trouble and moisture will collect on the cold walls and ceiling. In a relatively short time water will be dripping from the ceiling causing a real moisture problem.

To maintain insulating value, walls must be protected from penetration of the moisture given off by the birds with a vapor barrier placed between the insulation and the warm wall. Polyethylene is a good barrier because no moisture can penetrate if there are no breaks in the sheet and splices are tight. It is most important to keep the insulation dry: if it becomes wet it loses its thermal resistance.

Temperature Control

Temperature controls nearly all ventilating systems. In the winter months one has to minimize the heat loss, and maximize use of available heat. The moisture and carbon dioxide expired must be exchanged for fresh air, warmed to the environmental temperature of the house.

It requires a tremendous amount of heat (1,100 B.t.u.'s to evaporate each pound of water) if the moisture in the droppings must be removed by the ventilation system. The 360 gallons of water produced per day in a 10,000 bird flock equals about 2,880 pounds of water. It would require 3,168,000 B.t.u.'s per day to evaporate all the water in the droppings. In cold weather it would help to remove the droppings to reduce the heat requirement for removal of moisture from the building.

There is no magic temperature for a laying house, but 55° F. is a good goal. The USDA has demonstrated that egg production drops off at temperatures below 45° F. and above 75° F. Good production is maintained in quite a wide temperature range. Chickens seem to tolerate temperature fluctuations, but it takes more feed to maintain their body temperature as environmental temperature drops. Energy needed to maintain body temperature can be purchased as feed or fuel as supplementary heat for the laying house. Feed costs and fuel costs vary so that the relationship may not always be the same. But generally it costs two or three times more to supply the same heat energy in the form of feed as it does to heat the building with fuel.

Of course you must consider the costs involved for the investment, interest, and maintenance of a heating device. In many poultry houses there is economy in adding a small amount of heat to the cost of egg production.

Many diets are not changed a great deal to allow for changes in weather conditions. As a result the birds in a cold house consume more vitamins, minerals, and protein than they need to meet their energy requirement. This becomes a real waste of feed. The extra ingredients become a burden on the bird's disposal system in an attempt to maintain the proper balance in the bird's body.

Disease Control

Ventilation serves another very important role in our laying houses. As flocks become larger disease spreading from bird to bird can do more damage. The movement of air away from the sick bird so that it becomes well diluted or never reaches another bird is very important. All airborne diseases need moisture to survive. Usually these diseases are eliminated from the respiratory system with small droplets of water. If there is no ventilation, these organisms accumulate in the house and the chance of exposing other birds becomes much greater.

One of the real advantages of a high ceiling design with the exhaust fan in the ceiling is that it tends to lift the expired warm air above the chickens and helps surrounding birds avoid exposure. More heat is eliminated because it is exhausting the warmest air in the house. This system may need some supplemental heat to maintain desired room temperature. It could more than pay for itself in disease control and medication savings.

The lack of oxygen is critical when there is no ventilation, but very limited air movement will suffice. Moisture and temperature control are the real governing forces that determine the rate of ventilation required. In the winter months the laying house must be equipped so that moisture can be controlled. If this requires supplementary heat, it must be added.

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