

Construction, Insulation, and Ventilation of Game Bird Facilities ¹

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The main reason to build housing for game birds is to provide protection from the weather. Housing also provides protection from predators, reduces the spread of disease organisms, provides protection from vandalism and makes possible the separation of birds by age or other grouping.

Housing Considerations

The first considerations when planning a new structure to house game birds are the size of structure and the space requirements. The design of a structure also will depend on the type of bird (quail, pheasant, etc.) and whether the structure will be used for brooding, growing, breeding or as flight pens. Many different building materials can be used to construct satisfactory housing. Wood, metal, concrete, and concrete blocks are the primary materials used.

The site of any animal facility should be carefully selected. The following are some of the factors that should be taken into consideration when selecting a site:

1. Florida receives considerable amounts of rainfall at particular times of the year. Select a location high enough to avoid flooding.
2. A remote site may be desirable to minimize human contact, especially when raising birds for release in hunting preserves. However, ease of access for feeding and handling should be considered.
3. The availability of water is essential. Electricity also may be necessary if supplying light for brooding.
4. Orientation of the building with respect to the sun and to prevailing winds is important. Orienting the long axis of the building in an East-West direction is recommended to minimize heat gain in the summer.
5. Florida's sensitive environment and high water tables make it essential that the soil type, slope and drainage of the site, and the possibility of the seepage of nutrients and waste into the aquifer be considered.
6. Florida is becoming more and more urban. Site any new construction with neighbors in mind. Neighbors may view dust, odors, noise and traffic as nuisances. They are likely to react more favorably to well built structures with neat appearances.
7. In urban areas, zoning ordinances may dictate the type of construction; they may even prohibit the construction of agricultural buildings.

Complete an economic analysis of construction, operation and maintenance costs, and expected income to determine a rate-of-return on your investment. Consider future use of the facility. Build with flexibility in mind; you may decide to expand your business or even change to a different kind of business.

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Construction

Most game bird housing in Florida is wood frame construction with open sides for ventilation. Any housing must be built for Florida's climate.

Wind Resistance

Buildings must be built to resist the high winds that occur during Florida's thunderstorms and hurricanes. Hurricane clips and nailing strips must be used to tie the roof to the frame of the building and to tie the frame to the foundation. Make sure the building frame is fastened to the foundation or use a post frame construction (i.e., a pole building).

Moisture

Proper ventilation will help reduce or eliminate problems associated with damp or moist conditions. Use pressure-treated lumber where high moisture conditions exist (i.e., contact with the ground). Make sure metal is galvanized or painted.

During cold weather, the chance of moisture condensing on the inside surfaces of exterior walls and roofing members is high. To reduce the possibility of this occurring, place a moisture barrier over the inside surface of insulation.

Insulation

Why Insulate?

Insulation is any material that reduces heat transfer from one area to another. Insulation can be used to provide more comfortable conditions for birds and to conserve heating energy. By reducing heat flow, insulation provides more even control of ambient temperatures.

Insulation can be used in the ceiling or under the roof, in walls and in curtains. In a new structure, placing insulation directly under the roof is more desirable than installing an insulated ceiling. Placing insulation in either the ceiling or under the roof will be effective in reducing radiation on birds, but insulation under the roof provides fewer nesting places for potential pests (e.g., rodents, birds). When retrofitting an existing building, however, it is often easier to install an insulated ceiling than to install insulation directly under the roofing.

Insulation with a Vapor Barrier

Moisture condenses on the inside surfaces of building materials when the temperature of the material drops below the dew point of the inside air. This is the same thing that happens when moisture condenses on the outside of an iced

drink. Insulation with a vapor barrier helps keep moisture from reaching the cold interior surface of an exterior wall or roofing member while the insulation helps maintain a more comfortable environmental temperature. Just remember that the vapor barrier is to be placed on the inside surface of the insulation, the side facing the room.

Additional Considerations

While insulation has several benefits, it also adds to the cost of a building. Furthermore, many types of insulation can be used as nesting material by birds, rodents, and insects. Also, some types of insulation lose their effectiveness when wet.

Types of Insulation

The most common types of insulation, unfortunately, are soft materials that are attractive to pests as a food source or as nesting material. Batt and blanket material and foam materials can be used if tightly enclosed but are generally not the best choices for poultry housing. Loose fill insulation provides ideal nesting material for pests and is not recommended for bird housing.

Reflective coatings and radiant barriers are shiny materials used in the attics of residential housing to reduce the radiant heat load. These coatings quickly become dirty and lose their effectiveness in poultry housing and they are not recommended.

A class of insulating materials called rigid insulation can be effectively used in bird housing. Sheets of rigid insulation are made from wood by-products, cellulose or expanded plastic materials such as polystyrene. The outer surfaces of these sheets vary in hardness, but some types are strong enough to last in poultry housing.

The effectiveness of insulation is measured by its R-value. The R-value, or the thermal resistance, is the resistance of a material to heat flow through each square foot of its surface area per hour for each degree Fahrenheit of temperature difference between the inside and outside surfaces of the insulation. Good insulating materials have high R-values.

Ventilation

The main function of a ventilation system is to remove heat and moisture from a building. A ventilation system also maintains an adequate oxygen level and removes carbon dioxide, ammonia, dust, and odors.

Natural Ventilation

Natural ventilation relies on natural physical principles to generate air movement by using open-sided construction to allow the wind to blow through the sides of a building. Sides should be as open as possible to let air flow freely through the building. The eaves of the roof should be a minimum of 8 -to 10-feet above the ground.

Natural ventilation also takes advantage of the chimney effect. The chimney or stack effect occurs because hot air is less dense than cool air and thus rises. By providing ridge and eave openings on a closed-sided building, a constant flow of air is produced if the outside temperature is cooler than the temperature at floor level inside a building. The chimney effect is most useful in cold weather under still conditions.

Forced or Mechanical Ventilation

Mechanical ventilation may be a consideration for larger operations. Mechanical or *forced* ventilation uses fans to move air through a house. These systems are usually negative pressure or exhaust systems where the fans act like pumps to force air out of the house. Pumping air out of a house produces a lowered air pressure inside the house. The outside air pressure then forces air into the house through air inlets. Mechanical ventilation is very effective and is easy to control using thermostats and time clocks.

The air enters across the top of the curtains along the side of the building in conventional exhaust systems and the location of fans is not critical. The broiler industry is using a type of exhaust system called tunnel ventilation that places the fans at one end of the house and locates all of the inlets at the opposite end. Air is drawn through these large inlets and moves down the house in a wall-like fashion. The air entering the house can be cooled by drawing it through evaporative cooling pads or by using fogging nozzles spaced throughout the house.

Tunnel ventilation uses more exhaust fans than are used in typical curtain-sided houses. With tunnel ventilation, air moves down the house with a velocity in the range of 350- to 400-feet-per-minute (fpm) (4- to 5-mph). Velocities in the range of 350- to 400-fpm produce a windchill effect that can produce a cooling effect equivalent up to a 10°F temperature drop. This effect drops as air temperature increases, but still produces cooling even when temperatures reach the mid to high 90s°F common during Florida summers. When more cooling is desired, an evaporative cooling system is needed.

Mechanical ventilation adds to the initial and operating costs of a house. The temperature sensors used by the thermostat must be accurate and reliable. Electrical service must also be reliable. Fans require regular maintenance. Fan blades and shutters must be kept clean, and fan belts must be kept tight. A standby power system is recommended to provide electricity for fans and cooling systems when power fails. Side curtains on mechanically ventilated houses must be equipped with automatic systems that cause the curtains to open when the power to fans fails.

Curtains can be operated manually, but it is recommended that they be controlled by a thermostat so that the size of the wall opening depends on the temperature. They should be checked to make sure that they fit tightly during cold weather operation.

Preventing Condensation

During the summer, a ventilation system's main purpose is to remove heat from the inside of houses. During the winter, it is desirable to keep heat inside houses and keep heating bills low. However, the ventilation system must still be operated during cold weather for moisture control. The moisture generated by the birds must be removed from the house to prevent damp conditions which can lead to condensation on walls and ceilings. Using a vapor barrier with insulation, as discussed above, is one way to reduce condensation.

For winter ventilation in most buildings, operating the ventilation system periodically throughout the day with a time clock will control condensation. The amount of ventilation will range from ¼ to 2 cfm per bird depending on the bird size. The fans should operate on a 5- or a 10-minute timer, although using a 5 minute timer will provide more uniform conditions in the house. The time of operation should be adjusted to keep the relative humidity between 50 and 70 percent. In a house with young chicks, the humidity should be on the high end of this range. If the humidity drops below 50 percent, airborne dust can become a problem. If the humidity rises above 70 percent, the chance of condensation increases.

Evaporative Cooling

Evaporative cooling refers to the cooling effect produced when water evaporates. The energy used to evaporate water is taken from the air, cooling the air as energy is removed. Evaporative cooling is the most inexpensive way to cool air. The pumps and fans needed for evaporative cooling are less expensive to buy and much less expensive to operate than

conventional air conditioning that uses a refrigerant in a vapor-compression cycle.

Evaporative cooling has big advantages when costs of installation and operation are considered. However, evaporative cooling has two disadvantages. The first is that as water is evaporated, the humidity of the air is increased. The second is that the amount of cooling that can be produced depends on the air's relative humidity. Evaporative cooling systems can still be effective in Florida because even though humidities are high, they are the lowest during the hottest part of the day. Figure 1 shows the averages of hourly temperature and humidity readings for all 31 days of August of 1996 near Gainesville. The figure shows that when temperatures rose to the mid 90s°F just after noon, the relative humidities dropped to around 50 percent.

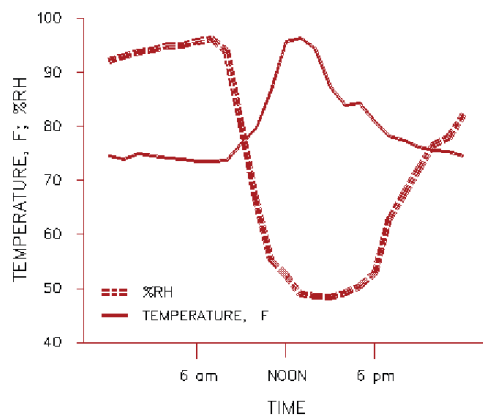


Figure 1.

A variety of evaporative systems can be used including evaporative cooling pads, fogging nozzles or pads and nozzles. Systems using evaporative cooling pads alone always have problems with a temperature increase in the air as it moves down the length of the house, so many systems use evaporative cooling pads in combination with fogging nozzles or they just use fogging nozzles alone.

Cooling Air as it Enters the House

Evaporative cooling pads at the air inlet produce the coolest air entering the house, but are more expensive to install and require more fan power to pull air through the pads. Pads also can have problems with algae buildup and will need to be periodically replaced.

Fogging nozzles at the air inlet are less expensive to install than cooling pads but do not cool the air as quickly. Nozzles have problems with clogging and must be protected with

filters. Fogging systems run at pressures of 100 psi or greater and require a booster pump.

Fogging Nozzles Inside the House

Nozzles spaced at even intervals inside the house can provide cooling and avoid the differences in temperature from one end of the house to the other. Fogging nozzles are installed in a system of water lines that are run under the ceiling. An effective layout of nozzles is to run fogging nozzle lines from sidewall to sidewall and in such a way that they drain to main lines running the length of the house.

The amount of water added to a poultry house by fogging nozzles must be regulated. On very hot days, all of the nozzles should be used for maximum cooling, but on cooler days you may need only one-half or one-third of the nozzles. The water flowrate to nozzles should be regulated so that nozzles do not put out more water than can be evaporated into the air. Water droplets falling to the floor result in wet litter. Leaking nozzles and plumbing also can create problems.

Use one-gallon-per-hour nozzles if water quality permits. Two-gallon-per-hour nozzles clog less frequently, but also are more likely to cause litter wetting. Do not place fogging nozzles within 60-feet of exhaust fans as water going through the fans will cause increased dust buildup on the shutters.

Roof Cooling

Another way to cool a poultry house is to reduce the temperature of the roof itself. One method is to sprinkle water on the roof. This effectively reduces the roof temperature, thereby reducing the radiant heat load on the birds. However, sprinkling is hard on roofing materials. Water quality is poor in many areas of Florida and water sprinkled on roofs can contain corrosive materials, such as sulphur compounds, that will greatly reduce the life of the roof. Even good quality water will often seep through roofing materials and keep rafters damp and cause them to decay.

A recommended way of reducing the radiant heat load on birds from the roof is to paint the top of the roof white. White paint is more effective than silver paint or galvanized metal in reflecting solar radiation. A shiny white enamel surface is best at reflecting radiation.

The roof temperature can also be reduced by providing a ridge vent to allow the hot air under the roof to escape. The vent should be 1 to 2 feet wide and should run the length of the building. An elevated cap should be used to prevent

rain from entering the vent. The cap should be high enough so that there is enough space between the eaves of the cap and the top of the vent to allow air to move freely through. The vent should be screened to keep pests out of the house.

Summary

Satisfactory housing for game birds can be provided by building new structures or by modifying existing buildings. Either way it is important that the structure be built to stand up to Florida's high winds and to be properly ventilated to provide comfortable conditions for birds in both the summer and the winter.