

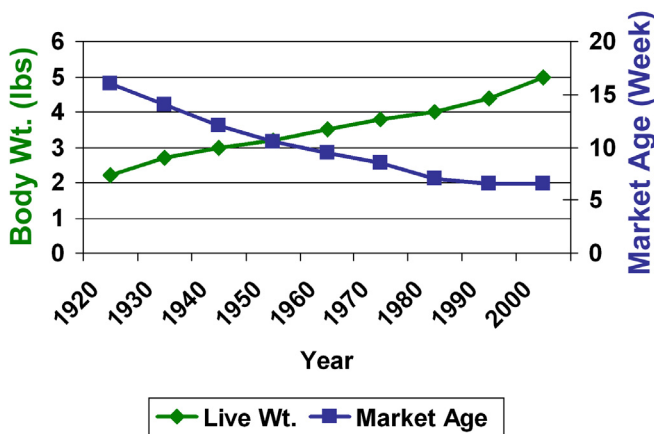


Basic Introduction to Broiler Housing Environmental Control

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Introduction

Broilers have been selected for increased meat yield, better feed conversion and high growth rates for many decades. Fifty years ago it took over 12 weeks to raise a 4 pound broiler. Through advances in genetic selection and nutrition, a 5 pound broiler can now be raised in 6 to 7 weeks. Genetics and nutritional improvements in broiler production have been extremely important to the efficiency of poultry meat production; however, the full genetic potential of broilers can not be reached unless the proper environment is maintained in the broiler house. The fast growing, modern broiler lines are more dependent on proper environmental conditions than birds from lines raised just a few years ago.



Broiler Performance

Construction

Broiler houses in the United States are constructed with wood or steel trusses and supports. The houses are clear span structures from side wall to side wall. The trusses are engineered to support the weight of the roof without the need of support posts that make it harder to catch birds and clean out the house. The floor is typically compacted dirt that is covered with bedding

material (wood shavings, peanut hulls, rice hulls, sand, etc.). House dimensions are usually 40-50 ft wide, 400-600 ft long with 8 ft high sidewalls.

Dropped Ceilings:

To improve ventilation and reduce heating costs, most houses now have dropped ceilings. Dropped ceilings protect the trusses and ceiling insulation by acting as a vapor barrier. Dropped ceilings reduce the ceiling surface area and allows for the installation of ceiling insulation to reduce heat gain in during hot weather and heat loss during cold weather. Modern houses are well insulated with blown in cellulose or fiber glass batt insulation to reduce heat gain in the summer and heat loss in the winter. Insulation values of at least R-21 and R-7 are recommended in the ceiling and walls, respectively.

Solid Side Walls:

Most houses are constructed with solid side walls rather than having open sides with curtains. This provides better insulation, reduces air leaks, provides better light control and allows the house to be heated more efficiently. The use of solid side walls provides a smooth surface compared to open sides walls with posts. This improves air speed during tunnel ventilation that will increase the cooling of birds next to the wall. Another trend in new construction is the building of larger houses. Houses as large as 70 x 600 ft have been constructed. If these houses prove to be cost effective, it is likely that most new houses will be constructed to larger dimensions in the future.



Broiler Houses



Clear Span Broiler House



Radiant Brooder



Pancake Brooder



Forced Air
Furnace



Radiant Tube Heater

Heating

Maintaining proper temperature to promote efficient growth is key to profitable broiler production. Thus, heating a broiler house is extremely important from both a performance and economic standpoint. Chicks are not able to completely maintain their body temperature until approximately 14 days of age. During this time, it is crucial that floor temperature be maintained between 85-90 degrees F with minimum variation. The primary fuels used in heating U.S. broiler houses are propane or natural gas. Broiler heating systems include radiant brooders, pancake brooders, forced air furnaces and radiant tube heaters. Brooders and tube heaters project heat onto the floor. The hot air furnaces heat the air, which then heats the floor.

Hot air is lighter than cold air. This can result in stratification with the air being warmer at the ceiling than at the floor. Circulation fans are often used to move hot air from the ceiling down to the floor. Using circulation fans to mix the warm and cool air can result in as much as 30 percent fuel savings and may improve litter conditions as the warmer air on the floor helps dry litter. Paddle fans can also be used to mix air, but be careful to ensure that the chicks are not exposed to drafts.



18-inch Circulation Fan

Ventilation

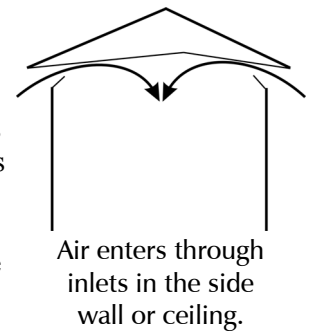
Ventilation delivers fresh air and removes excess heat, moisture and undesirable gases from the broiler house. A typical ventilation system in a broiler house consists of fans, air inlets, evaporative cooling system and controller/thermostats. Houses are designed to deal with both cold and hot weather extremes.

Cold Weather Ventilation:

During cold weather, negative pressure ventilation is used to provide fresh air, remove moisture and minimize heat loss. Fans exhaust air out of the house creating a slight negative pressure inside the house. Fresh air is pulled into the house due to the negative pressure and

enters through planned air inlets that are installed either high on the house side wall or in the ceiling. These inlets are designed to direct air across the ceiling allowing it to mix with warmer air located there and to heat up before coming into contact with the birds.

Newer houses use computer controllers to determine when the fans operate and for how long. The combination of controller and air inlets allows control of how much air enters the house and where it will enter and allows good air quality to be maintained while minimizing heating costs.



Air enters through inlets in the side wall or ceiling.

Hot Weather Ventilation:

During hot weather “tunnel ventilation” is used to keep birds cool. Tunnel ventilation systems consist of fans at one end of the broiler house and large air inlets at the opposite end. The fans pull air the length of the house at a velocity of 500 feet per minute. Tunnel ventilation removes heat from the building rapidly and creates a wind chill that provides additional cooling for the broilers.

When tunnel ventilation alone is not sufficient to cool the broiler house, the evaporative cooling system is activated. Energy in the form of heat is used to evaporate water lowering the air temperature. Originally, evaporative cooling was accomplished using fogging systems located inside the house. The fogging nozzles provided a fine mist of water that evaporated, thus lowering the air temperature. Occasionally there were situations when this system was not used correctly. As a result the air sometimes became saturated and all of the water did not evaporate, which led to wet litter problems. This problem was corrected by moving the evaporative cooling system outside of the house. Fogging systems were placed on the end of the house where the air enters. The fogging nozzles sprayed a fine mist of water onto fluted/perforated pads. The air was drawn through the pads where water was evaporated and the air temperature was reduced. This system also



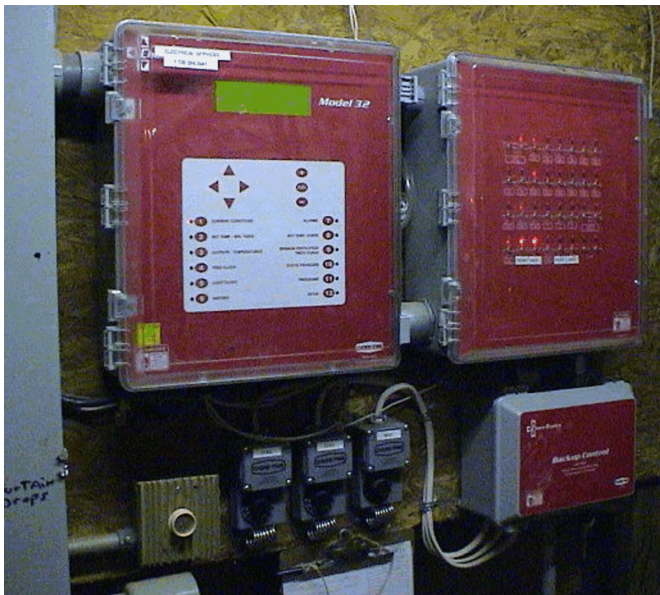
Recirculating Evaporative Cooling System

had drawbacks, sometimes causing large amounts of water being wasted as it dripped off the pads.

Recirculating evaporative cooling systems have become popular as a solution to this problem and is the primary evaporative cooling system being installed currently. With this system, water runs through a perforated pipe at the top of the cool cell pads. Water runs down and through the pad soaking it. Any water that is not evaporated is caught in a trough at the bottom of the pad that delivers the unused water back to a reservoir to be pumped through the system again. Depending on environmental conditions (temperature, humidity), incoming air temperature can be lowered 10 degrees F or more.

Controlling House Environment

Almost all modern broiler houses rely upon electronic controllers. Through the use of controllers, it is possible to keep house temperatures within five degrees of the desired temperature regardless of outside temperature. This makes it possible to keep the birds comfortable so they are not diverting energy from growth to stay warm or cool. The controller monitors house



House Environmental Controller

environmental conditions and adjusts the heating, ventilation and cooling equipment as necessary to keep temperatures constant. Today, controllers can monitor temperature in six or more locations throughout the house. Humidity can also be monitored, although adjustments to heaters and fans are usually done on a temperature basis.

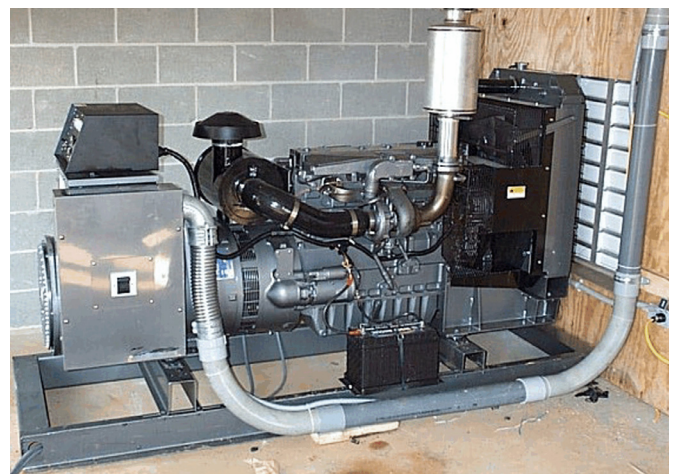
As the house temperature fluctuates, the controller will turn on the brooders or fans as needed. The controller operates equipment in the house including: brooders, fans, inlet machines, curtain machines, evaporative cooling systems and lights. Many controllers also allow house conditions to be monitored remotely.

Using a computer and modem, a grower can call into the farm and check the temperature and humidity, as well as, which heaters and fans are operating in all houses. If needed, changes in the environmental settings can be made remotely using the computer.

Alarms and Generators

The importance of the maintaining a comfortable and stress-free environment for the birds cannot be overstated. Modern broiler housing can provide the environment needed to optimize broiler performance, but this is entirely dependent on electricity and the proper operation of house equipment. It is difficult for a farm manager to be present 24 hours a day, every day that birds are in the house. Therefore, it is important to have an alarm system installed to let the farm manager know when something goes wrong in the house.

While the system will not correct the problem itself, its main purpose is the get someone into the house to evaluate and correct the problem. Alarms are used to notify if there is loss of power or if the house internal temperature gets too high or too low in relation to the desired temperature. The alarm system will activate a siren, usually located at the facility, to alert anyone



Generator

close by and an automatic phone dialer and/or pager to notify the farm manager while he or she is away from the farm. In the case of power loss, emergency generators are used to operate ventilation, feeding and watering systems to prevent catastrophic losses. The emergency generator should have the capability of automatic power switch-over and be capable of delivering service for extended periods of time to operate the systems mentioned above.

grower's bottom line and housing construction, equipment and operation will be paramount in helping to make sure the houses are operated as efficiently as possible. As technology and equipment is redesigned and developed, researchers will continue to examine how broiler housing can be heated, cooled, and built in such a way that modern broilers continue to reach their genetic potential using the most economical and efficient methods.

Summary

Research on improving broiler housing is ongoing. Energy costs are becoming more significant to the

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