



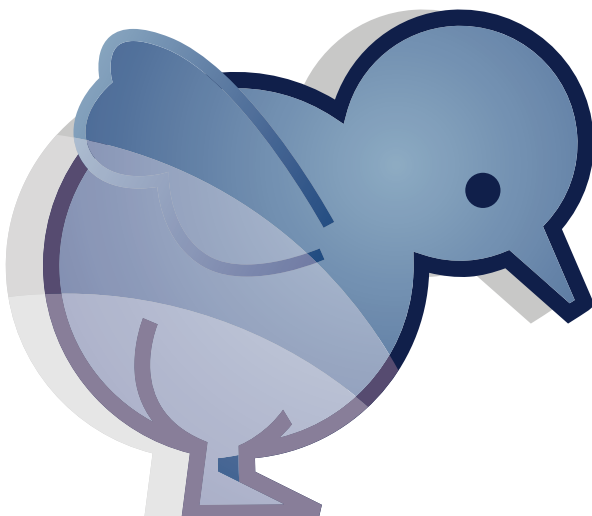
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Broilers in mechanically ventilated Houses and a closed Production Environment

Great demands are made on the climate system in the livestock house to ensure an exact adjustment of temperature, air humidity and air velocity, among other things, in order to create optimum conditions. Birds of highly improved breeds combined with a high stocking density require a climate of precise adjustment. There is only one correct temperature – if it is not sustained, an optimum productivity cannot be attained. It is therefore important to have some good production facilities and to choose the right ventilation system.





Climate Requirements of the Birds

The ventilation system must ensure that the day-old chickens can maintain a body temperature which makes them seek water and feed. The optimum temperature is very critical and in case of deviations, the productivity will decrease significantly. Later in the production cycle, the temperature must ensure the best productivity as regards weight and FCR.

If the air humidity rises, the birds sense a higher temperature even though the temperature is actually unchanged. Likewise, a low humidity can make the birds feel a lower temperature even though it has not been lowered.

The air quality is also closely connected with the air humidity. CO₂ is particularly critical at minimum ventilation; a ventilation level should be ensured, so the CO₂ concentration does not exceed 3000-3500 ppm.

The air velocity has the opposite effect of the air humidity. If the air velocity is increased, the birds sense a lower temperature even though the temperature is unchanged. This phenomenon is known under the name chill effect or chill factor. For full-grown broilers with a fully developed plumage, an air velocity of 1 m/sec. will cool the birds approx. 3° C. For day-old downy chickens, the ratio is much higher - here the same air velocity of 1 m/sec. will have a sensed cooling effect of approx. 7-8° C.

A uniform distribution of the broilers in the livestock house is one of the most important concepts in broiler production. A uniform distribution on the floor (the litter) should be ensured so all the birds have the same growing conditions - however with a minimum consumption of energy for heating and ventilation.

Different Ventilation Systems

Ventilation systems which meet the climatic requirements of the broilers can basically be divided into two categories. Naturally ventilated houses and mechanically ventilated houses in a closed production environment.

Naturally ventilated houses are production units in which the ventilation level is entirely regulated by increasing or decreasing the air intake; for instance by means of a curtain which can be pulled up or down. The air outlet is often not regulated but is typically conducted through an opening (constantly open) in the ridge of the roof. As an alternative, both the air intake and the air outlet can take place through curtains; one side works as air intake and the other as air outlet depending on the wind direction. It is thus the thermal conditions of the air that ensure the air change in the house. Naturally ventilated houses are often not insulated and not much importance has been attached to whether there are leakages in the building or not.



Naturally ventilated house.

Mechanically ventilated houses in a closed production environment enable you to control the environment in the production facility. The air intake is often conducted through wall inlets at a low ventilation level and through tunnel openings at high ventilation level. Air outlet is conducted by means of fans creating a negative pressure inside the house. The ventilation level can thus be regulated by increasing or decreasing the negative pressure in the livestock house and by opening the air intake a little bit more or a little bit less. The standard of the mechanically ventilated houses varies a lot; but it is important that there is a high standard in such houses, so the grower can carry out optimum control of the climate inside the house. This requires a tight and insulated building among other things.

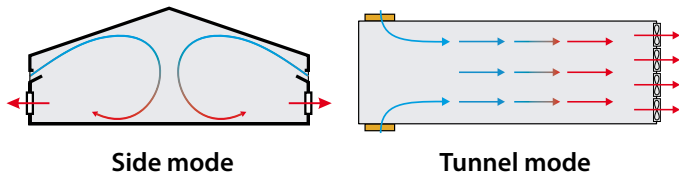


Mechanically ventilated house in a closed production environment.

Several different ventilation principles for mechanically ventilated houses are available. Side Mode, Tunnel and Combi-Tunnel are the typical ones. Side Mode ventilation applying wall inlets for air intake is particularly well suited for temperate regions. Tunnel ventilation - creates an air current lengthwise in the house and is well suited for regions where cooling by means of



air velocity is always required. Combi-Tunnel is a combination of the two principles - wall inlets are used to ventilate the house during a cool season and the Tunnel principle during the hot season. This principle is the most applicable ventilation system in the subtropical climate and in most tropical regions.



Choosing System

Naturally ventilated houses have been the conventional choice on many markets. It is the cheapest system as regards setting up and operation but does by no means provide the optimum conditions for broiler production. Natural ventilation requires a very constant and uniform outside climate in order to work. The requirement for a uniform climate can seldom be met. There will always be temperature differences as a result of changing wind directions, day/night and/or summer/winter.

When it is cold, Side Mode through wall inlets is the optimum way of ventilation as the incoming air is warmed up before reaching the animal zone whereas ventilation according to the Tunnel principle is the optimum ventilation during the hot season because the broilers are cooled by air velocity.

Likewise, downy day-old chickens have different climatic requirements than full-grown broiler with plumage. Other things being equal, the air velocity should be kept below 0.2 m/sec. during the brooding period and during cold weather conditions, whereas the air velocity can be increased later on in the production cycle, so the birds are cooled and the humidity from the birds is removed from the air. If looking at the entire production cycle, Combi-Tunnel is the most applicable ventilation principle.

Consequences when choosing a System

As mentioned earlier, natural ventilation often was the conventional choice. But making this choice can have serious consequences for the production. Below, we will focus on the disadvantages when choosing to ventilate according to the natural principle.

Cold periods

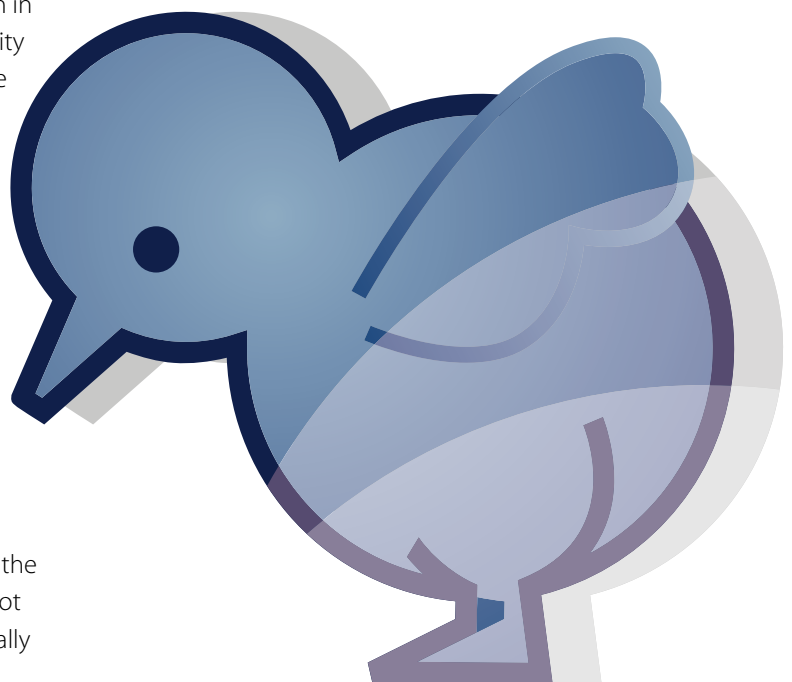
It will often be necessary to increase the heating level in the naturally ventilated houses during the cold periods. Quickly, the curtains are not tight anymore and the buildings are often not insulated. I.e., the heating costs are higher than in mechanically ventilated houses. If the house is not heated, the broilers will

use a greater part of the feed to maintain the body temperature. If there is insufficient heating in the livestock house, it is not possible to establish good production conditions. At Side Mode ventilation, it is possible to control the minimum ventilation optimally and thus also the energy consumption - this altogether optimizes the FCR.

Hot periods

During hot seasons, natural ventilation cannot create an adequate air movement around the animals. This results in a decreased feed consumption and a high mortality rate. We have seen many attempts to create this air movement by means of air circulators in livestock houses. These air circulators are installed to ensure a better distribution of heat when the birds are small and air velocity around the birds when they are somewhat older. Experience shows that the number of these fans increase over the years as a result of the grower trying to regulate the climate. But the energy consumption of these fans is often high and the results are usually not materialized because they cannot create uniform air velocities in the entire house. It has thus been seen that the energy consumption in naturally ventilated houses can exceed the energy consumption in mechanically ventilated houses during a hot season.

Tunnel ventilation naturally creates the cooling air current which the broilers need during the hot season for which reason the ventilation principle meets the climate requirements of the broilers in an optimum way and keeps up the growth rate during a hot season.



Temperature differences inside the livestock house

In naturally ventilated houses, we have learned from experience that temperature differences between day and night of up to 10 – 15° C may occur. The grower can never have an optimum production at so distinct temperature variations. Also, the indoor temperature can vary from one side of the house to the other with several degrees as a result of a greater wind pressure on the curtain in one side. In a house like this, it will never be possible to have a uniform distribution of broilers with the same growing conditions for all of them. In mechanically ventilated houses, it is to a greater extent possible shutting out the outside climate and create an optimum environment.

Air quality

Often, it will also not be possible to meet the requirement for air quality in a naturally ventilated house. It is not possible to increase the ventilation level, so the CO₂ concentration does not exceed 3000-3500 ppm. Modern climate computers used to control the ventilation in livestock houses are able to regulate the CO₂ concentration by changing the ventilation level. Often, it is possible to connect a CO₂ sensor directly to the climate computer which enables an automatic control of the minimum ventilation based on the CO₂ concentration.

Stocking density

If the livestock house is mechanically ventilated, it is possible to produce with a higher stocking density. Again, the grower has to take into account that the ventilation system must be dimensioned so the ventilation level is sufficient when the broilers are ready for slaughter under the hottest production conditions imaginable. If the house is naturally ventilated, it is not possible to regulate these conditions.

Litter

A uniform litter is an important factor to make the broilers distribute evenly. If the house is naturally ventilated, it is not possible to ventilate more in combination with heating. For that reason, one often sees a poor litter in naturally ventilated houses. In these houses, it is difficult to avoid problems with litter; once the litter has been damaged by dampness, the grower lacks the "tool" to restore the litter - like heating and a ventilation system ensuring good and uniform distribution of the air in the house.



Conclusion

If the grower has a good grasp of temperature, air humidity and air velocity, he is well on the way to having a homogeneous production. It will often be impossible to create the right conditions in a naturally ventilated house. Problems maintaining the right and a constant temperature, keeping the air humidity down and meeting the air quality standards will typically occur.

In mechanically ventilated houses, the grower controls the environment and he is provided with tools to regulate the climate by means of ventilation level and heating. If the grower chooses to establish a system combining the ventilation principles Side Mode and Tunnel in a Combi-Tunnel principle, he can in addition make the principle independent of the outside climate.

The quality of the buildings for controlled ventilation must be high in view of the air intake; no air is allowed access through openings not intended for air intake.

Both higher production results and a higher stocking density are realizable in houses with a well-functioning mechanical ventilation system.