

Getting the environment right

Raising birds at the correct temperature is not just a welfare matter, but also influences profits (or losses). Additionally, with global warming knocking on our doors it is gaining more importance, while toxic gases and dust levels are other points of concern.

By Dr Rogério G. T. da Cunha

Environment control is a very complicated issue, and livestock producers are aware of that. They are dealing with many more variables than those who are involved in other industrial sectors. There is a crucial difference between their and our business. Their non-organic systems or machines can be managed with great precision and detail to make the best use of them in order to optimise performance. The “machines”, in our case, are biological creatures with little to no uniform behaviour, and an immensely complicated internal working physiology that is. Even more important, broilers (or any other production animal) are basically converters of feed into animal protein. They do so in a manner we still do not fully understand. That is especially the case when it comes to understanding the mechanisms that play a role in the interaction between feed and water intake and environmental conditions. Additionally, given the constant decrease in profit margins and the increase in competitiveness, there is a pressing need for productivity gains.

A substantial impact on these issues relates to the housing environment. Dr Irenilza de Alencar Nääs from the Department of Agricultural Engineering at UNICAMP (University of Campinas, São Paulo State, Brazil) recently spoke about this topic at an event

for the poultry sector in Brazil. She summarised some findings and presented recommendations, mostly focused on the climatic conditions prevailing in Brazil (or other countries with hot climates).

Some (don't) like it hot

When exposed to high temperatures, broilers alter their behaviour in order to facilitate thermal exchanges and heat loss. This ends up having a negative impact on productivity, explained Nääs. During high temperature periods, broilers show higher levels of prostration (which leads to appetite loss or fast), excessive wing opening and panting. Nääs added that birds also search for places where the temperature is more pleasant or where adiabatic (a thermodynamic process that happens without loss or gain of heat) cooling is facilitated, such as close to drinkers.

The birds also show physiological responses, like diverting the blood flow from internal organs to the skin, to stimulate thermal exchanges. “A negative aspect of this is that some of these changes trigger a vicious circle, since the increase in muscle and lung activity is generating even more heat inside the body. Once high temperatures are accompanied by high air humidity, the situation becomes even worse. This is because panting efficiency is reduced, which

Insulation, roof design and material, location of the house, its surrounding and shadow are important issues for the in-house temperature.

means that the vicious circle can become even more dangerous, and quite fast so,” Nääs warned.

One wonders if these behavioural and physiological responses do indeed have an impact on productivity. The answer is a big “Yes”. Sadly, however, the impact is negative. When the temperature increases to around 28-30°C, Nääs explained, the broiler’s energetic efficiency is reduced. This means a higher feed conversion rate, which translates into lower profits. Heavy and older birds suffer even more from heat stress, and are more easily led to exhaustion and ultimately death. “To have an idea,” Nääs detailed, “panting can take 540 cal/g of water away from the lungs in 40-day old birds. This is a figure far from negligible.”

To complicate matters even further, broilers of different ages have a distinct thermal sensitivity and different requirements. Nääs explained that during their first days of life chicks require heating to live in an environment with a temperature of 30-34°C. However, their comfort zone changes to 24°C at four weeks, and to 21/24°C when they become 6 weeks old.

Dust is in the air

Temperature is not the only ambience problem inside barns. Dust and gases produced by the litter and droppings interact with the thermal conditions. In addition, they have an effect on the health of the birds, as well as on the health of the workers in the barn.

Nääs recalled that these latter concerns began at farms in temperate climate zones, but later spread to tropical regions, like Brazil, with the adoption of climate controlled and closed houses.

Besides the known problems of gaseous ammonia for birds and humans, liquid ammonia present in the bedding induces callosities (thickening of the skin) and contact dermatitis (skin inflammation) in the plantar pads and breasts. These lesions consequently result in a drop in bird performance and condemnations in the processing plant.

Dust has a different effect on birds. It lowers their thermal exchange efficiency during breathing. Most of the dust inside animal houses is composed of organic matter and may contain great amounts of fungi and bacteria, which may lead to negative effects on bird health and performance.

Tips and tricks

“Moving air solves several of the problems mentioned - everybody knows that, but things are not as simple as they look at first sight,” Nääs continued. “Just like human beings, broilers like wind - be it natural or artificially produced. It lowers their thermal sensation up to 6°C and widens their comfort zone. By manipulating their thermal sensation, birds believe that they are in another temperature so their body does not have to spend energy on thermal compensation.” But there are limits. When the temperature is above 38°C, an increase in ventilation rate alone does not ensure a decrease in thermal stress. In this situation, one has to combine ventilation with cooling. One can make use of misters, unless relative humidity is very high. Under humid conditions, misters have no or little effect, Nääs completed. She also said that combining ventilation with cooling has led to an increase in carcass quality, a 33% decrease in mortality and 40% less carcass condemnations.

Other aspect she considers extremely important in the quest for adequate thermal control is the abundant supply of fresh water at a temperature lower than the internal temperature of the birds (which is 42°C). The reason is quite simple to grasp: panting leads to water loss through lungs; water loss leads to an increase in water consumption by the birds; and a low water temperature will help dissipation of internal heat.

Some authors, as Nääs mentioned, suggest the use of salts in drinking

water, because they are beneficial both due to their very own presence and their ability to stimulate the bird to increase water consumption. Other researches advise low protein diets with the addition of synthetic amino acids, since an unbalanced amino acid intake can increase metabolic heat.

Nääs believes that the best strategy for Brazil (and presumably other hot climatic places as well) is to combine positive and negative ventilation to better control both temperature and NH₃ levels. It is her experience that tunnel ventilation does not lead to thermal uniformity inside the barns and it increases the dust and ammonia concentration close to the exit. The result is that the air that leaves the poultry house may cause environmental problems, such as acid rain. By employing both ventilation types, NH₃ emission can be decreased.

To lessen the effects of thermal stress, Nääs suggests that temperature control should be made according to the bird's age and the local climatic conditions with an eye on possible heat waves. Precision in the measures and real-time monitoring are of utmost importance. It is her opinion that we should have a decision-tree to diagnose the thermal environment by using behaviour (such as chick distribution, prostration, threats, pecking, and so on) as indicators of thermal conditions or stress. The ideal situation, according to Nääs, would be to achieve a constant temperature around 25°C.

“Thermal stress is the largest controllable cause of losses”

Global warming

Due to global warming, the scenario for poultry production is quite worrying, since an increase in average temperature of up to 3°C is expected. This will increase the energy expenditure in cooling systems while growing birds will demand a higher efficiency in the control of thermal stress. In regions with hot climates, the situation may be even worse. High temperatures can be devastating to commercial systems, especially in combination with high humidity, as it easily happens in the summer in large parts of Brazil. Over the last few years, Nääs says, we have observed the situation worsening through an increase in the number of heat waves. Extreme temperatures occur in consecutive days, while there is not much cooling at night. “This takes out opportunities for the birds to recover. Global warming seems to increase the frequency and intensity of heat waves, so we must be ready to deal with the problem. House design



Dr Irenilza de Alencar Nääs: “Precision in the measures and real-time monitoring are of utmost importance in keeping optimal environment conditions.” (Photograph by César Machado from Vale Press)

requires a proper climate control system. It is the only strategic way out. We must also pay attention to insulation, roof design and material, location of the house, its surrounding and shadow. It is never enough to emphasise the importance of reflectance and thermal insulation of the roof, given the high values of direct sun radiation in Brazil,” Nääs highlighted.

Words to remember

Climate control is a complicated but very important issue, Nääs stressed. She emphasised that scientific results have shown that carcass quality is directly related to the housing environment. So, besides losses in the number of birds, wrong ambience parameters may also have product quality implications.

The world is conscientious and is demanding cleaner, safer and more efficient production systems. Brazil is in the forefront of adapting housing systems that combine positive and negative ventilation, resulting in the production of half the amount of ammonia compared to other systems. “We should use this fact to add value to our products,” Nääs said.

“Meanwhile, we should not increase our flock density because that can lead to more pollution problems, an increase in barn temperature, a depressing effect on bird welfare, and a negative impact in the country's exports.” She believes that, when thermal stress is low, a density of up to 35 kg/m² does not jeopardise carcass quality. In that respect, her advice is more or less in line with the new EU broiler welfare directive. ■