The use of tunnel ventilation and evaporative cooling systems are now critical to optimizing bird performance of both breeders and broilers in hot climates, writes ROBIN SINGLETON*.

Hot weather broiler and breeder management

Extremely high temperatures have a much greater effect on the faster growing, higher yielding broiler of today than its less efficient ancestors. When it's hot outside, it is essential to create an environment inside the poultry house that allows the birds to dissipate excess body heat and remain comfortable.

Recent advances in housing design have greatly improved, providing the opportunity to control environmental conditions inside the poultry house and optimize poultry performance in hot climates. In such high temperature climates however, there are secondary issues to the environmental which include insect vectors, bacteria and mycotoxins. In these challenging conditions it is essential that key management techniques are applied in order to gain maximum performance of stock.

In the extremes of the Southern Asian climates (a tropic, sub tropical region), ambient temperatures can range from anything between 15°C to 45°C during the year and the diurnal temperature range (the difference between day and night) can be 20°C. Relative humidity, which will affect the apparent temperature the birds feel, can range from 30% during hot dry seasons, to 90+% in the hot wet seasons.

Bird biology in relation to temperature

The chicken's natural body temperature is approximately 41°C, although this rises slightly during the day and falls slightly during the night. The bird maintains it by employing sensible heat loss methods i.e. heat loss from the body to environment by radiation, convection and conduction, and also to some extent by water evaporation from the skin or latent heat loss. These methods must be equal to the heat produced within the bird's body from digestion, absorption and metabolism of feed, so that the bird balances energy and heat production to maintain its body temperature.

An important mechanism in the process of heat regulation is the control of blood flow to the peripheral tissues, especially the comb, wattles and legs. This process, known as peripheral vasodilation, increases blood flow which moves heat from deep inside the body to the surface, to be lost to the surroundings.

The effect of heat stress

As environmental temperature rises, a change in behaviour of the birds will become evident. Key points to note are: wings being held away from the body to assist heat loss; reduced activity to limit heat production from muscular efforts; an increase in water consumption and a decrease in feed intake.

About 75% of the metabolisable energy consumed by the bird will be converted to body heat and required to be lost to the environment. Thus reduction in feed intake is an important physiological safety mechanism to reduce heat stress.

As temperatures rise, the ability of the bird to lose heat by conduction, convection and radiation decreases. At this point, it will then try to lose heat by panting, which assists the evaporation of water from the moist linings of the respiratory system. This evaporative cooling initially involves the process of passing air rapidly in and out of the mouth and is the principal means of regulating body temperature in heat stress situations. However, at higher temperatures water also evaporates from the air sacs within the lungs during panting, lowering the levels of blood carbon dioxide and inducing a process called respiratory alkalosis. This condition can have a serious impact on broiler performance, particularly when accompanied by decreased feed intake, due to the decreased potassium and minerals balance.

When heat production exceeds the bird's ability to dissipate heat, birds will lie prostrate and gasping on the floor, which results in them becoming weaker and susceptible to death from respiratory, circulatory and/or metabolic imbalance.

Managing the poultry house environment

Ensuring a good environment inside the poultry house and providing the opportunity for birds to dissipate excess body heat and remain comfortable is of primary importance.

Hot weather ventilation must be able to provide:

- Adequate air exchange.
- Removal of heat from the bird by control of air speed.
- Adequate evaporative cooling of incoming air.

The use of Tunnel Ventilation gives adequate air exchange and acceleration of the speed of air ▷

flowing over birds. This air speed helps increase body heat dissipation and the loss of heat by convection and is otherwise known as the wind-chill or cooling effect.

The absolute thermometer temperature no longer tells us if a bird is comfortable. What determines bird comfort is the combination of absolute temperature plus air speed over the bird.

This is particularly important at higher humidity levels when the effectiveness of evaporative heat loss, which occurs when birds pant, is reduced. At higher relative humidity, increasing the air flow over the birds promotes heat loss by convection.

The use of evaporative cooling reduces the temperature of the incoming air, reducing the absolute temperature. The effectiveness of evaporative cooling greatly depends on the relative humidity of air coming in to the system. At over 70% humidity the cooling effect is reduced and cooling systems should not be used once humidity reaches 80%.

Tunnel ventilation and evaporative cooling used in conjunction allows good control of poultry house environments in tropical climates.

Correct management of these systems is the key to managing poultry profitably in these climatic conditions.

Where open housing is still used, natural ventilation must be optimized and entry of direct sun light minimized through house design, orientation and exploitation of the natural topography. Use of internal standing fans will give some control over air flow and are essential equipment in these types of houses.

Table 1: Suggestions for house type and stocking density for broilers.

House Type	Maximum stocking density at slaughter (kg/m^2)
Controlled Environment	30
Controlled Environment during hot periods	24-26
Open – Sided (OS)	20-22
OS during hot periods	16-18

Bird management and nutrition

One of the key factors to consider is stocking density. Reducing the stocking density reduces the number of birds producing heat and so reduces the amount of heat that must be removed from the house to maintain temperature. Future hot weather can be anticipated and placement numbers should be planned accordingly, taking into account the likely outside temperature and humidity, the type of housing, the capacity of the ventilation system and the type of stock housed (Table 1).

Water management and supplements

Water consumption increases during hot weather and so an adequate supply of cool, fresh water should be available to birds at all times. As an approximate guide, water consumption increases by 6% for every 1°C rise in temperature from that at 20°C where it is approximately 1.8 – 2.0 times feed quantity.

Management concerns include drinker space, free access to drinkers, cleaning of drinkers when open drinkers are used and monitoring of water pressure in nipple lines.

The addition of 8g per 100 litres of sodium bicarbonate to the drinking water (or 2.5g/kg in the feed) can be useful in heat stressed broilers to stimulate water consumption.

Fortification of water with vitamins and electrolytes is also prudent especially in circumstances where feed intakes are low due to the effects of hot weather.

Feed specifications

Increasing nutrient intake during heat stress, by changing the feed specification, may have an adverse affect on survivability, but increasing the digestibility of nutrients and the use of specialist micro ingredients has been shown to have benefits.

The principle nutrients to consider are:

- Proteins and amino acids: nutrient digestibility should be increased rather than nutrient density. Minimize excess protein, balance amino acids and minimize the crude protein level in the diet.
- Energy: the diet should be supplemented with fat rather than carbohydrate. Increasing the energy density of the diet will increase growth rate but will also increase heat output.
- Vitamins and Minerals: certain vitamins are known to have a positive effect on the birds' response to heat stress including Vitamin E, D, A, C, B2 and nicotinic acid. Under no circumstances should vitamins be withdrawn from the diet.

Feeding management

As temperatures rise, the bird has to maintain the balance between heat production and heat loss, and so will reduce its feed intake. As a guide, feed intake is reduced by 1.25% for every 1°C increase in temperature, trials indicate that this reduction increases to 5% for every 1°C rise between 32-38°C.

Reduced feed intake is the main cause of poor performance at high temperatures and the feeding

practises below have been shown to have a positive affect on survivability and performance of birds experiencing heat stress:

- Ensure good physical quality of feed (crumb, pellets or mash) to encourage appetite. If floor space allows add extra feeders.
- Feed should not be stored for longer than one week to reduce the possibility of mycotoxin build up.
- Encourage eating at cooler times of the day as it takes 2-4 hours after feeding before the maximum energy is generated and the bird must dissipate the metabolic heat generated.
- Remove feed 4 to 6 hours prior to an anticipated heat stress period. Birds should not be fed or disturbed during the hottest part of the day.
- Dim the lights while feeding – low light intensity during periodic feeding reduces activity which reduces heat load.

Other points for breeder flocks

- Monitor eating up times and record them on a daily basis.
- Stressful procedures such as beak trimming and grading should be carried out during cooler times of the day.
- Males with a full comb will be much more capable of losing heat than those without.
- Where reduced feed intake occurs this can increase susceptibility to calcium tetany. To ensure adequate calcium is available for eggshell production, feed oyster shell grit as a scratch feed. If feed intake is reduced by 20g per bird per day, then calcium intake falls by approximately 0.56g. Feeding 1.5g of oyster shell grit per bird will replace this.

Other points for broiler flocks

- Sexed growing allows separate ventilation of the slower feathering and faster growing males.
- Good brooding management with an understanding of ventilation requirements is essential to ensure chicks get a good start.
- A lower daily feed intake (80%-90%) is compensated for by a longer growing period.
- For broilers frequent feeding and stirring of feed in the feeder should be encouraged to stimulate intake.
- Depletion should be well organized with care taken in handling birds. Water should be available until the last birds have been depleted and feed withdrawal should occur 2-6 hours before depletion. Efforts should be made to avoid moving birds in the hottest part of the day and to eliminate waiting at the factory.

Summary

The use of tunnel ventilation and evaporative cooling systems are now critical to optimizing bird performance of both breeders and broilers in hot climates.

These systems linked to good management practice play an important role in minimizing the effects of heat stress in hot weather.

The advice given here will help to maximize the dissipation of the heat produced by the bird in a hot environment, while minimizing any negative impact on biological performance. ■

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