TURKEYS: hot weather management and nutrition

Thermoregulation is the ability of birds to maintain their body temperature across a range of environmental temperatures. Turkeys use a variety of physiological and behavioural mechanisms to maintain body temperatures.

by The Technical Team, Aviagen Turkeys Ltd, UK. www.aviagenturkeys.com

Hot weather (generally above 27°C) can have a detrimental effect on flock performance. The effect of high temperature can be exacerbated by high humidity. Further, birds which are not used to warmer conditions may find it more difficult to adjust to hot weather.

In regions where hot summers are common, bird housing should have already been designed with features to minimise the likelihood of heat stress. This article provides practical advice for managers to reduce the effects of heat on flocks by modifying husbandry and nutritional practices to improve bird comfort and reduce the impact on flock performance.

Ventilation

Increase ventilation rates and lower thermostat settings at cooler times of the day to reduce latent heat and allow birds to recover from hotter conditions.

Ensure all fans are in working order, belts are tightened and fan housings are kept free of dust.

Minimise obstructions which may reduce air-flow: trim vegetation around the sheds, clean slats and vent openings to remove dust accumulation, keep screens and light baffles clear of dust and feathers.

Direct hanging fans so air flows across the birds. Air movement at bird level has a cooling effect by removing body heat from the birds.

Fully functioning and properly set alarm systems are essential in hot weather. Take care when altering alarm system settings to ensure they are appropriate for the difference in day and night temperatures. Separate day and night alarm settings may be required. Test life-support systems before placement and thereafter weekly. Check alarm systems, check and run automatic generators, test emergency ventilation (curtain drops etc).

Evaporative cooling

- Test all fogging and evaporative cooling systems prior to use each summer.
- Fogging/misting nozzles can become clogged; hoses and pipes can become cracked. Depending on the system these need to be kept clean/dry to prevent a high microbiological load being spread onto the birds when starting to use them.
- Dripping nozzles will reduce mist onto birds, decrease the cooling capability of the system and create wet spots. Watch for drips and repair as needed.
- Fogging systems should be run at service technician recommendations on temperature and timer settings.
- Check egg storage conditions.

Table 1. Turkeys use a variety of physiological and behavioural mechanisms to maintain body temperatures.

METHODS OF HEAT LOSS	BEHAVIOURAL AND PHYSIOLOGICAL ACTIONS
Radiation – loss of heat by radiation to cooler surrounding surfaces	Seeking shade/cooler areas
Convection – heat loss via natural rising of warm air	Reducing activity
Conduction – heat transfer by contact with a cooler surface	Panting
Evaporation – heat loss from respiratory surfaces	Spreading feathers
	Vasodilation
	Reducing feed intake

Water

- Monitoring daily water consumption will indicate potential problems.
- Header tanks should ideally be situated within the house or insulated, painted white and screened with shading material if situated externally.
- Ensure all drinkers are in working order. Adjust drinker height and water depth weekly. Increase water depth if required.
- Ensure free access to cool water throughout the shed by providing sufficient drinkers for the number of birds being grown. Extra drinkers may be required in hot weather.
- Cooling water to lower temperatures will also assist the bird's thermoregulation. Ideally water should be cooled to below 25°C; levels in excess of 25°C will result in reduced water intake. Water can be cooled by flushing water lines, adding ice to header tanks or altering water lines to run along the base of cool pads.
- Consider using electrolytes to reduce stress on birds at key times. Look for electrolyte packs with stabilised vitamin C.

• Excessive heat (>85°F/29°C) – run electrolytes during daylight hours and fresh water overnight.
• Loading birds for processing – run electrolytes 24 hours before load.
• Moving birds to grow out – run electrolytes for 24 hours before moving.

Work schedule

Avoid handling or moving birds during the warmest time of day. If required, events such as bird movements, weighing, vaccination, re-bedding/litter tilling etc should be done at cooler times of the day. Avoid birds becoming crowded.

Feeding

Feed intake and digestion can raise body temperature by as much as 7%. Feed withdrawal during the hottest time of day should be considered as long as there is compensation in feed intake in the cooler periods.

Run the feeding system during the cooler times of day.

Bird condition

Ensure bird bodyweight and condition is optimal prior to the onset of hot weather, this will ensure the hen has adequate reserves when feed intake is compromised.

This is achieved by ensuring the birds are in a positive body weight trajectory from 22 weeks to lighting up, the feed density needs to be adjusted if weight gain is not keeping to target.

Continued on page 9

Continued from page 7

Egg shell quality

As birds hyperventilate during heat stress, there is increased loss of CO_2 gas via the lungs. Lower CO_2 in blood causes blood pH to elevate or become alkaline resulting in a condition called respiratory alkalosis. Higher blood pH results in reduced calcium and carbonate ions transferred from the blood to the shell gland (uterus) resulting in thin, weak egg shells.

Increasing the amount of calcium in the diet will not correct the issue however restoring the acid/base balance through supplementation with potassium chloride or sodium bicarbonate has been shown to improve the bird's tolerance to heat stress.

The bird also excretes more electrolytes during hot weather, higher sodium levels may be required (increased by 0.02% to 0.03%). The ratio of chloride to sodium should increase to between 1:1 to 1.1:1 in hot weather conditions. The target electrolyte balance (molar balance equivalence of Na^++K^+-Cl^-) should be approximately 240-250 m Eq/kg.

Nutrition

Breeder nutritional strategy should be adjusted for hot weather.
Key points:

- Adjust nutrient specification levels to ensure sufficient intakes of key nutrients, vitamins and minerals.
- The diet formulation should focus on reducing heat associated with digestion.
- Consider the use of anti-heat-stress additives.
- Feed physical quality is important to maintain intake and reduce heat stress.

Feed consumption

Closely monitor feed consumption of the flock during hot weather; feed intake can reduce by as much as 30% during hot conditions. Adjust the diet nutrient specification levels to ensure intake of key nutrients is maintained. The critical nutrients are digestible amino acids, energy, calcium, sodium and phosphorus.

Formulation approach

Energy contribution from starch has a higher heat increment – heat associated with digestion – per unit of energy compared to lipid (fat). Increasing the energy contribution from oil addition to the diets will reduce body heat production and reduce the heat-burden on the bird.

Insufficient digestible amino acid intake is one of the main reasons for productivity loss during hot weather, however excess crude protein supply should be avoided.

Metabolism of excess dietary crude protein involves significant energy expenditure by the bird to deaminate excess nitrogen.

Minimising excess crude protein reduces the metabolic load on the bird during heat stress, reductions in dietary crude protein by as little as 0.5% (while maintaining digestible amino acid density) has been associated with improved production during hot weather. Proteins derived from animal sources have higher heat increment values than vegetable protein sources.

Formulating to digestible amino acids rather than crude protein is a means of avoiding excess crude protein intake by the bird. There is also evidence that formulating to an ideal amino acid profile results in more efficient use of amino acids in warmer environments. Higher arginine to lysine ratios are associated with improvements in heat tolerance.

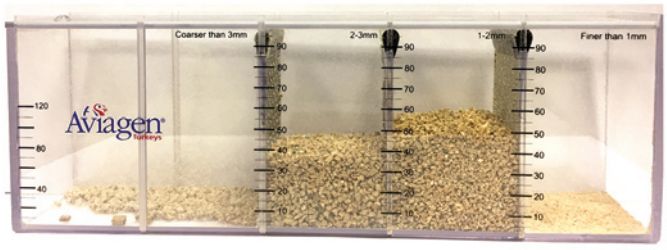
Due to the decrease in feed intake during heat stress the intake of vitamins and trace minerals is also reduced. Use of higher levels of vitamins, provided as a 'booster' pack, can be fed at strategic periods.

Try to anticipate periods of heat stress and implement the dietary changes ahead of the hot weather. It is preferable to increase the micronutrient intake by the bird prior to the onset of heat stress and maintain intakes throughout the hot weather period. It is useful to quantify the degree of reduction in feed intake during the period of stress and calculate the overage of micronutrients to compensate for this reduction.

Heat generates free radicals like $O_2^{\bullet-}$ and $HO^{\bullet}$ which may harm cell membranes by inducing lipid peroxidation of polyunsaturated fatty acids within the membrane. These reactions produce heat and contribute towards failure of thermoregulation and increase body temperature during heat stress.

Some vitamins act as antioxidants preventing the harmful effects of free radicals. The key vitamins to consider are: E, A, C and B-Complex. All of these vitamins are considered beneficial to the bird during heat stress conditions and to the immune system, especially when used in combination.

Trace minerals provided in an organic form are considered more bioavailable than inorganic forms. Organic forms of zinc, copper manganese and selenium are the key trace elements to consider.



Feed physical quality can have a significant effect on how the bird deals with hot weather conditions.

Table 2. Summary of nutrient specifications for a 'standard' and 'hot weather' breeder diet.

	Units	Standard	Hot weather
Temperature range	°C	21-32	>32
	Fahrenheit	71-90	>91
Energy	Kcals/lb	1,280	1316
	Kcals/kg	2,820	2,900
	MJ/kg	11.8	12.2
Digestible amino acids			
Lysine	%	0.74	0.84
Methionine	%	0.37	0.42
M+C	%	0.61	0.67
Tryptophan	%	0.16	0.17
Threonine	%	0.53	0.57
Arginine	%	0.77	0.87
Calcium	%	2.8	2.9
Available phosphorus	%	0.38	0.41

Use of a 'summer' feed formulae should incorporate the following:

- Compensate for reduced feed intake.
- Decreased crude protein – use vegetable protein sources.
- Formulate to digestible amino levels.
- Heat increment value of fat is lower than carbohydrate and provides more of a 'cooling effect' on the bird – supplement the diets with fats/oils.
- Use of elevated levels of key micronutrients – vitamin and trace elements.

An example of a nutrient specification for a summer breeder diet compared to a standard breeder diet is shown in Table 2. This specification is suggested in areas with very hot summers with consistently high temperatures during the day and night.

Feed physical quality

Feed physical quality can have a significant effect on how the bird deals with hot weather conditions. Good feed physical quality allows the bird to consume the feed efficiently without expending an excessive amount of energy. Poor feed physical quality tends to have the opposite effect.

The bird expends more energy and generates heat trying to consume the feed it needs, this heat becomes an added burden on a bird which is already experiencing heat stress. Providing optimal feed form, consistently, will also support compensatory feed intake during the cooler periods of the day or night.

Additives

A number of additives have been shown to assist in reducing the effects of heat stress. Consult your local nutritional and veterinary practitioners regarding their local use.

Aspirin (acetylsalicyclic acid) is considered an anti-heat stressor through its effect on increasing vasodilation and blood flow to the body's extremities.

A combination of acetylsalicyclic acid, ascorbic acid, potassium chloride and sodium bicarbonate has been shown to prevent heat stress related depression in performance.

Betaine has osmotic properties which help to maintain homeostasis of the body, addition of 2kg/MT of feed has been shown to have benefits on egg production and egg shell quality under heat stress.

Phytochemicals such as lycopene and resveratrol elicit antioxidant effects by either down regulating pro-inflammatory responses or up regulating anti-inflammatory responses. ■