

Heat Stress Management in Broilers¹

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High ambient temperatures can be devastating to commercial broilers; coupled with high humidity they can have an even more harmful effect. Heat stress interferes with the broilers comfort and suppresses productive efficiency. During periods of heat stress the broiler has to make major thermo-regulatory adaptations in order to prevent death from heat exhaustion. The result is that the full genetic potential of the broiler is often not achieved.

The purpose of this paper is to review some of the effects of heat stress on broilers and methods which can be used by the poultry producer to partially alleviate some of the detrimental effects of heat stress on broiler performance.

What is the broilers natural physiological response to heat stress?

Broilers subject to high environmental temperatures exhibit many behavioral changes which allow them to re-establish heat balance with their surroundings. Broilers rest more during periods of heat stress. Some birds will stand quietly while others simply crouch near walls or waterers. Usually, their wings are spread away from the body to promote cooling by reducing body insulation. Within the bird, blood flow is diverted from certain internal body organs such as the liver, kidneys and intestines to dilated blood vessels of the peripheral tissue (skin) in order to facilitate heat loss.

Hyperventilation or “panting” increases during periods of high environmental temperature. Heat loss through evaporative cooling allows the broiler to dissipate the heat it is generating. However, panting requires increased muscle activity and this results in an increased energy requirement which is associated with heat stress. Therefore, decreased energy efficiency also accompanies hot weather. Panting would normally be expected to occur when the ambient temperature is near or above 30°C. Relative humidity influences evaporative heat loss through panting. Broilers, as well as other domestic poultry, cannot tolerate high temperature coupled with high relative humidity. Death due to heat exhaustion will occur very quickly, especially in heavier birds, if both temperature and humidity are high. In normal birds, panting will remove approximately 540 calories per gram of water lost by the lungs.

How will panting influence pH or acid-base balance in the broiler?

Normally, blood pH is controlled by the lungs and kidneys along with the various buffer systems which prevent rapid changes in the pH. However, as the respiratory rate increases in heat stressed broilers, there is a corresponding decrease in the levels of blood carbon dioxide. Respiratory alkalosis (elevated blood pH) results. Heat stress also depletes potassium and other minerals in the body, altering the delicate electrolyte balance in the body.

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Should a decrease in feed intake be expected during heat stress?

Yes. Broilers maintained in hot environments reduce their feed consumption. This is a part of their physiological adaptation to heat stress. The reduction in feed intake results in a decrease in the daily intake of nutrients responsible for growth. However, fewer nutrients to metabolize means less heat produced by the body. Thus, even though growth is slowed, the broiler can now more easily cope with the heat because of the lessened need for heat dissipation. Research data clearly shows that the survival rate of broilers decreases as feed intake increases during heat stress, especially during the hottest part of the day.

Why is fasting beneficial during heat stress?

In addition to heat-stress mortality, economic losses associated with broiler heat stress also occur as a result of lowered growth rate and decreased feed efficiency. Therefore, it is natural for producers to want to stimulate feed consumption in hot weather. However, any management technique which promotes feed consumption or increased activity during the peak hot periods may be counterproductive. The extra feed consumed will increase the bird's heat load and probably result in additional mortality. Fasting the broiler prior to or during peak hot periods of the day lessens the heat load and enhances survival.

Fasting reduces the heat production from digestion, absorption and metabolism of nutrients. Fasting also has a calming effect. Movement in animals occurs through muscle contraction which generates heat. In hot environments this heat production only adds to the heat load. Therefore, to lessen the heat load, broilers should be kept as calm as possible. This is especially important during the hottest parts of the day. Once the hottest periods are over and ambient temperature starts to fall, the broilers will usually begin consuming feed again.

What alleviates heat stress in broilers?

In hot/humid environments with open-style houses adequate air movement and water consumption are essential. Ventilation should be maximized. Air movement facilitates removal of build-up ammonia, carbon dioxide and moisture. Panting is accompanied by an increase in water loss by the lungs. Therefore, more water has to be consumed by broilers during hot weather in order to

prevent dehydration. Cool drinking water stimulates both feed and water intake. Reducing the body temperature of heat stressed broilers is beneficial. When the temperature of drinking water is lower than body temperature it will absorb body heat. Therefore, providing adequate and cool drinking water is extremely important to heat stressed broilers. Usually, anything that results in increased water consumption during heat stress will benefit the survival rate. In fact, some researchers have attributed the increased survival rates of heat stressed broilers receiving supplemental salts such as potassium bicarbonate, potassium chloride, sodium chloride and ammonium chloride to the increased water consumption which results, not to the salts.

Can dietary adjustments promote better performance of broilers under heat stress?

Yes. Heat stress causes broilers to decrease feed intake and consequently nutrient intake. Therefore, the dietary nutrient concentrations should be increased. Simply increasing the protein concentration is the wrong approach. The energy content of the diet, along with other nutrients, should be increased. Increasing fat calories should be considered. Dietary vitamin and mineral concentrations should be re-evaluated. The use of vitamin C, as an anti-stress agent, is often considered during periods of heat stress. Choosing the correct coccidiostat is very important as well as the use of antioxidants and mold inhibitors in stored feed. Protein contributes more to metabolic heat production than do carbohydrate and fat. Therefore, feeding imbalanced diets with regards to amino acids will result in increased metabolic heat production. Amino acid balance in the diet is especially important. Efforts should be made to formulate diets with slightly lower protein levels and to utilize synthetic amino acids, especially methionine and lysine.

Summary

Broilers under heat stress have to make critical life sustaining physiological adjustments. Feed intake is depressed and water intake is increased. Dietary adjustments can help reduce metabolic heat production and maintain nutrient intake. Energy intake and amino acid balance is of extreme importance in heat stress. Providing adequate ventilation and stimulating water consumption is essential. Minimizing bird activity during the hottest parts of the day lessens the heat burden. Controlled fasting is beneficial and usually increases survival rate of broilers during heat stress.