**Avoiding Heat Stress Mortality in Poultry**

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Summer time can represent a stressful time for production poultry. Warmer seasonal temperatures decrease feed intake, performance and affects the immune system. Life-threatening combinations of high temperature and humidity call for emergency procedures to reduce mortality. *Sudden increases in temperature as the spring moves into summer* are particularly stressful for older birds that are not yet acclimated. Heat stress occurs as the core body temperature continues to increase to fatal temperatures because heat removal is insufficient and metabolic coping mechanisms are limited. For most poultry, the thermoneutral zone is between 60-75 F which is the temperature range where heat production is at a minimum. As temperatures increase to the upper critical temperature of 85 F, the bird adjusts to the increasing temperature by behavioral changes and decreases in feed intake and production. These adjustments are sufficient to keep core body temperature from increasing. As air temperature increases toward the critical thermal maximum temperature of 100 F, heat gain exceeds heat loss and core body temperature will increase toward lethal body temperatures unless relief is provided. It should be noted that the temperatures given above can shift depending on humidity, management and building conditions as demonstrated by the mortality in flocks in 1995 as described in the next paragraph.

In 1995, Minnesota lost an estimated 375,000 turkeys (MTGA, 1995) due to heat stress between July 11$^{th}$ and 14$^{th}$. Weather characteristics that probably contributed to the high mortality loss were: cool temperatures the week prior to July 11$^{th}$, the pattern of increasing high and low temperatures starting on July 10$^{th}$, and little or no wind speed during that time period. For the time period of July 12$^{th}$ to the 14$^{th}$, air temperatures were above 85 F for 33 hours. During this time period the maximum day time temperature was 99 F on July 13$^{th}$ with night time low of 78 F. Dew-point temperatures were 70 F or greater from 10 AM July 11$^{th}$ to 7pm July 14$^{th}$. Dew-point temperatures greater than 75 F were experienced for 42 hours in that time period. Analyses of the temperature data indicated mortality occurred as outside air temperatures increased above 95 F. Mortality was particularly severe in older age flocks or younger birds that were crowded.

Heat is produced by the bird through metabolic activities for maintenance, growth, muscle activity, feeding and egg production. Heat can also be gained (heat “flows” from hotter to cooler temperatures) from the environment as air temperatures increase, energy from building lights or sunlight or contact with warm surfaces or other birds. In trying to minimize the effect of warm temperature, heat loss needs to be equivalent to the heat gained. Under most conditions heat transfer is managed through ventilation/air flow. However there may be times ventilation maybe limiting and birds continue to gain heat.

As air temperature continues to increase past 85 F, the bird responds by trying to loose more heat through evaporative cooling which is accomplished by panting. However this process also generates more heat as the panting also generates heat through muscular activity. The panting changes the acid base balance of the blood. Water intake increases but is not sufficient to keep up with losses through respiration and increased urinary excretion. Without corrective action, the changes become acute and bird can no longer sustain itself.

Ideally, increasing ventilation to remove heat from the birds should be the first priority. However, situations may exist where ventilation is limiting. Heat stress strategies when ventilation becomes limiting would involve those to limit heat gain and increase efficiency of heat loss. Much work in this area has been conducted by Teeter at Oklahoma State University. As mentioned earlier, heat is produced during the feeding and metabolic activities involved in growth. Most often birds will be hungriest in the morning and will tend to fill up. Unfortunately, this predisposes them to heat stress in the afternoon. One management strategy for turkeys and broilers has been to withdraw feed 6 hours prior to the peak warm temperature in the afternoon. Feed can be re-introduced after peak temperatures have started to recede which allows feeding during night time hours when cooling is expected. Some body weight reduction might be observed depending on the frequency of use and therefore should be used only when heat stress temperatures are expected.

Another method is the use of electrolytes in the drinking water. Heat stress causes increased loss of several minerals including potassium, sodium, phosphorus, magnesium and zinc. Several electrolytes have been studied for their efficacy in combating heat stress. Potassium chloride, ammonium chloride, sodium bicarbonate, sodium chloride have all been tried. Potassium chloride appears to increase water intake when supplemented in the drinking water at concentrations of 0.6% and has been generally more effective than other potassium and sodium salts. As in feed restriction therapy, the supplementation should occur prior to the heat stress period. Sodium bicarbonate in the feed or use of carbonated water is especially useful for hens in egg production as panting and carbon dioxide release impacts the acid base balance and the bicarbonate available for egg shell formation.

Water supplementation with vitamins (A, D, E and B complex) was also shown to be effective combating heat stress mortality in broilers. In breeding poultry, Vitamin C has been shown to be effective in moderating warm temperature declines in egg production and eggshell quality in laying hens and sperm production in breeder males.

Of course other management and building/equipment activities to prepare for warmer summer temperatures and prevent heat stress should not be ignored. Water management is one such area. Water management in general is critical, as water intake will increase by 2 to 4 times that of normal during heat stress. Having sufficient water space, operating waterers and cool water temperatures will help encourage water intake.

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