Tech Seminars

Tech Seminar #03 – Calf Management in Summer, Part 1

Introduction

Welcome to Calf Notes! My name is Dr. Jim Quigley, author, and webmaster of Calf notes.com. Thanks for stopping by and I hope you'll find this Calf Note to be informative. This is Calf Note #219, entitled "Calf Management in Summer, Part 1". In this video series, I'll discuss a bit about the physiology of heat in young calves, and in the next Note, I'll outline some practical aspects of keeping calves cool in summer. Ok, let's get started!

There are many effects of calf performance on future productivity… including environmental effects like heat and cold. Today we'll discuss how heat stress affects calves and what we can do about it.

We are learning more and more about prepartum effects on calf growth, health, and future productivity. This is an important area of research, but one we will not discuss in this presentation

Here is an outline of what we'll discuss today, as we discuss summer management for calves. The main points include thermoneutral zones, determining heat stress in calves, effects on production, and finally what we can do to manage calves differently in the summer.

We are all area aware of thermoneutral zones – the temperatures within which animals use no additional energy to maintain their body temperatures. Temperatures below the TNZ require calves to generate heat to stay warm and temperatures above the TNZ requires the animal to use energy to dispel heat. Note that the TNZ depends on the class of animals and stage of maturity.

When the animal reaches the upper critical temperature, or UCT, it will change its metabolism to try to eliminate heat. Behavioral effects such as sweating, panting and change in posture are easy to observe. The animal will tend to eat less and drink more water. Metabolic changes also occur, such as redirection of blood to the surface of the body to help eliminate heat. Changes in nutrient metabolism and hormonal changes also occur. The end result is a reduction in performance, for example, growth or milk production, and an increase in maintenance ME requirements.

I'm sure you're familiar with the famous tables on THI that allow us to determine when adult cows are stressed by the heat. There are numerous equations used to calculate THI, but the results are

generally similar. The general categories of THI indicating heat stress are shown here and were developed years ago at the University of Arizona, in one of the hottest regions within the US.

Although we know a lot about heat stress in cows, the situation is very different with calves. The first efforts to determine when calves became heat stressed were done in the late 1970's and early 1980's. Neuwirth estimated that 3 to 4-week-old calves were heat stressed at 32°C and 60% humidity. This calculates to a THI of 83. On the other hand, Gebremedhin and coworkers reported indices of heat stress when calves were above 29°C and 50% humidity, or a THI of 77.

More recently, Kovacs et al conducted a more complete evaluation of heat stress measures in Holstein bull calves. They used several indices of heat stress – respiratory rate, rectal temperature, ear temperature, heart rate, and salivary cortisol. They conducted a broken-line regression to estimate the point at which metabolism of the calf changed. The breakpoints for each measure differed a little. The THI indicating heat stress were: respiration = 82.4, rectal temperature = 88.1, ear temperature = 83.0, heart rate = 78.3, and salivary cortisol = 88.8. Using heart rate and respiration as parameters, it seems that heat stress begins when THI is above 78 to 82. A reasonable average from this work suggests that a THI of 80 would be an appropriate indicator of heat stress from this study.

Let's take a look at the changes in body temperature when calves are exposed to various temperature. This study was conducted at Cargill's Technology Application Center in New Paris Ohio, which has a continental type climate with hot, humid summers. We can see that body temperatures were lowest at approximately dawn (6-7 a.m.) and increases throughout the day. Maximum temperatures for moderate or cool times of the year are reached at about 1600 hours, and then temperatures decline thereafter. However, in the hot times of the year, body temperature continued to increase until approximately 2200 hours, and then declined to early morning lows. This shows the importance of night cooling, which allows the calf's body temperature to return to normal prior to the heat of the next day.

When exposed to heat stress, calves respond quite quickly as they try to dissipate excess heat. This research, done many years ago, shows changes in rectal temperature and respiration rate when calves were exposed to different ambient temperatures at a fixed humidity. You can see that respiration rate reacts quite quickly. The highest rates of respiration were 120 and 145 breaths per minute and were achieved at about 2 hours, for calves exposed to 30 degrees and less than 60 minutes when they were exposed to 40 degrees.

SO… why are calves more resilient?

There are several reasons. The first is that they have a greater surface area, which has more capacity to dissipate heat. The second reason is that calves – especially young calves – have less extensive rumen fermentation. Of course, the rumen is a fermentation vat, which produces significant heat. This is particularly useful in cold climates, but in the heat, this fermentative heat is very stressful. Until rumen fermentation reaches normal levels, this heat of fermentation is

relatively low. Also, the rumen, as a percent of body weight is less than what we see in adult cattle, at least until approximately 4 months of age. Finally, the diets we feed to calves tends to be highly digestible with limited amounts of forage. This reduces that fermentative heat. As a result, calves are more resistant to heat stress. It appears that THI values above about 80 would indicate heat stress in calves. The older the animal and the greater the forage in the diet, the closer the threshold THI will be to that of an adult. However, we don't have good data to indicate this rate of change.

The research data suggest that if we use heat abatement strategies such as changes to nutrition, management, and housing, we can reduce effects of heat on calves and improve their growth and efficiency.

In our next Calf Note, we will look at some management strategies to reduce heat stress in young calves. These will be addressed in 4 parts, moving air, providing shade, bedding types and nutritional strategies.

Well, I hope this video has been helpful and the information can be used to improve the health and welfare of many young calves. Thanks for watching!