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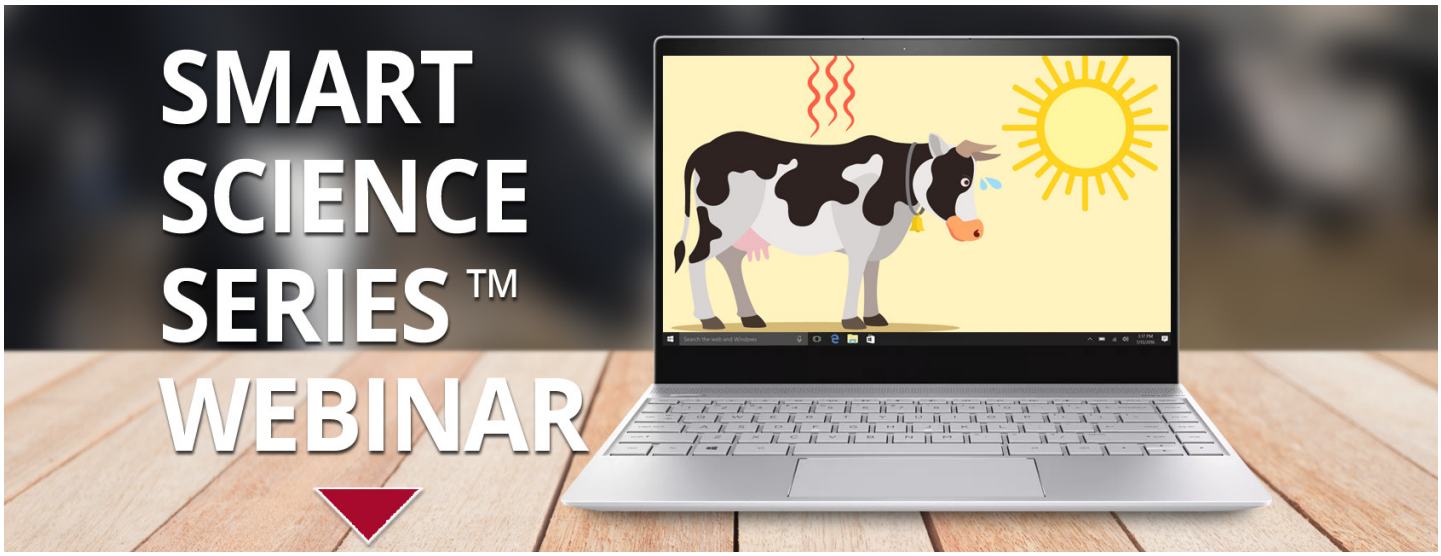

Dialing down heat stress mechanically and nutritionally

A Smart Science Series Webinar from Adisseo

With Dr. Bob Collier, University of Idaho, and Dr. Phil Cardoso, University of Illinois - April 29, 2021

Answers to Questions Asked, Courtesy of:

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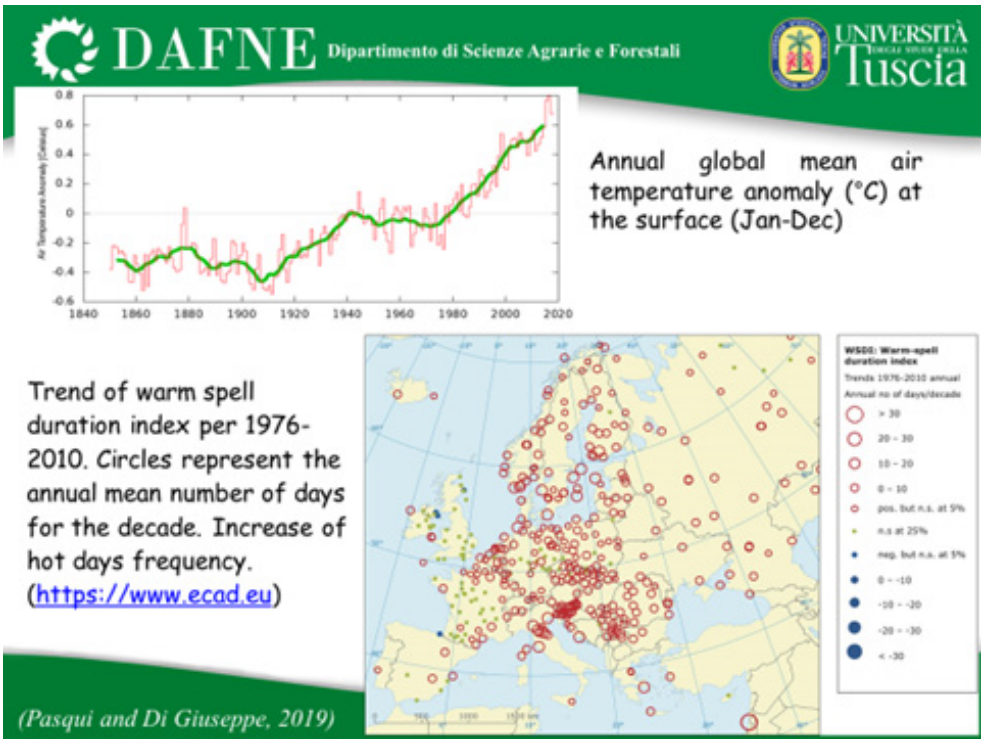
Q: Prof. Bob Collier, please comment on water curtain cooling system.

Dr. Collier: The Arshad study was a meta-analysis. Levels of metabolizable methionine in the trials retained for the meta-analysis ranged from 1.65% to 2.65%.

Q: Bob, you are talking about wind speed as an effective way to cool down cows. What wind speed (meters/sec) do you advise as a maximum on animal level?

Dr. Collier: Assuming the air temperature is below the skin temperature of the cow (90 °F), then a wind speed of 2-3 M/sec is a good speed to cool cows.

Q: How many days of heat stress per year, either in "hot" countries (Spain, Mexico…) or temperate countries (England, northwest Europe)?



Dr. Collier: Here is a slide from Dr. Umberto Bernabucci showing warm spell duration in Europe and Russia over the last decade. As you can see, it has increased dramatically.

Q: What are the estimated global losses in milk production and composition? And how much of that could be prevented by using adequate cooling conditions?

Dr. Cardoso: Cost: (lost productivity, mortality, health, etc.).

American Agriculture: > $4 billion/year.

Global Agriculture: > $150 billion/year.

Q: What are the long-term effects of heat stress on cows?

Dr. Collier: Long-term effects of heat stress include hoof and leg problems associated with recurring bouts of rumen acidosis, reduced health because of increased mastitis, reduced reproductive performance which might cause loss of the animal from the herd, increased death rates in sick cows, and reduced milk yield overall. Carryover effects of heat stress on the next lactation have also been documented as well as reduced performance of calves born after late gestation heat stress.

Q: Are there any new technologies on the horizon regarding heat abatement?

Dr. Collier: Conductive cooling of cows using cooled bedding is a potential opportunity for use in dairies, and this approach would have some benefit during winter months as well. The mechanical cooling equipment currently available is operating at near full capacity.

Q: How much methionine is advised per cow per day based on your research during heat stress periods to be effective, and how much methionine for a close-up cow (HF cow of around 650-750 kg BW)?

Dr. Cardoso: A good strategy is to make sure that an adequate amount of methionine is being fed. I would suggest keeping it at 1.17g /Mcal of ME. I would suggest the same amount for a close-up cow. However, for the close-up cow, make sure at least 1,200g of metabolizable protein is being fed.

Q: How is methionine preventing the fall in milk protein? Can it be used as an energetic amino acid related to glucose demand?

Dr. Cardoso: One indication is by reducing the number of dead alveoli in the mammary gland. Also, the increase in liver functionality index when methionine is fed may allow for improved hepatocyte function overall. Indirectly, yes through the mTOR pathway.

Q: Could heat stress provoke milk protein instability or does it only reduce the protein level in milk?

Dr. Collier: Yes, heat stress reduces protein stability and cheese yield during summer months.

Q: Is the loss of milk during heat stress due to the decrease in DMI or the oxidative stress itself?

Dr. Collier: Only 50% of the decrease in milk yield during heat stress can be accounted for by reduced feed intake. The remainder of the loss is due to a variety of factors including oxidative stress and altered nutrient partitioning as well as the direct impacts of heat stress on the milk synthesis process.

Q: What is the role of Zn in heat stress?

Dr. Cardoso: Zinc is a component of the enzyme superoxide dismutase (SOD). SOD is involved in reducing oxidative stress by scavenging reactive oxygen species. This is one example of how Zn can reduce the oxidative stress caused by heat stress.

Q: With the K levels during heat stress, what is the ideal K/Na ratio? I wonder if it is only DCAD or DCAD together with a K/Na ratio. Only using NaBiCarb is way cheaper than also using KCab.

Dr. Cardoso: During heat stress, the ratio between Na and K is not clear since providing more K increased DMI linearly, and that was not the case for Na. DCAD and buffering capacity are not always the same. More research is needed to establish the buffering capacity at the same DCAD levels.

Q: Does the requirement for chromium increase during heat stress?

Dr. Cardoso: More research is needed to establish this relationship.

Q: Apart from Na, Mg, and K, is chromium helpful during heat stress?

Dr. Cardoso: There is restricted data on chromium supplementation to dairy cattle. There is indication that Cr may increase insulin sensitivity and, therefore, be beneficial during heat stress. More research is needed to confirm the hypothesis with different dietary strategies (i.e. with methionine).

Q: How high could you go in potassium?

Dr. Cardoso: I would go for ~1.20 % of dietary DM. Let's see what the new NRC brings.

Q: Is the difference in milk components larger during summer in the University of Illinois herd? Were there also advantages on milk fat?

Dr. Cardoso: Good point. We can look into it. However, since it is less directly associated with AA more confounding is expected (forage source and quality is a big one).

Q: With the University of Illinois herd, it looks like the impact of feeding AAs on milk protein production compared with cohorts separates wider over time, why is that?

Dr. Cardoso: Most likely a combination of progressively learning how to better feed for amino acids and some, still to be determined, epigenetic effect.

Q: Why do cows under heat stress have lower plasma AAs?

Dr. Cardoso: A lower capacity for amino acid transamination due to hepatocyte compromise (oxidative stress), heat shock proteins taking the circulating AA, and leaky gut are plausible causes.

Q: Do buffers help against heat stress? How about bypass fats? Can HMTBa (for example RumenSmart™ or part of MetaSmart®) help against heat stress?

Dr. Cardoso: Yes. We can chat about it since we can expect rumen environmental changes due to the loss of buffer/salivation by the cow. Would that change HMTBa utilization by the cow?

Q: Does Adisseo make a premix to reduce heat stress?

A: No. Adisseo does not offer a premix to reduce heat stress. However, its protected methionines are available to feed and premix companies for their use.