Effects of Heat Stress on Dairy Cattle Reproduction

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Reproductive failure is one of the main reasons that dairy farmers cull dairy cattle. With lower reproductive performance, cows have longer days open, longer lactations, reduced milk production per day of life, and often produce less profit for their owners. Heat stress has a big effect on the cow’s reproductive performance. While most farmers know that the effects of heat stress on milk production start at a temperature humidity index (THI) of 68, the effects on fertility can start at even lower THI with some scientists suggesting it may even start at a THI of 50. When heat stress occurs, conception rate can decrease by 53%. Understanding the causes for this decrease in fertility during heat stress and ways to decrease these effects are discussed in this article.

Heat stress affects the cow and her calf:
- Estrus expression is reduced. During periods of heat stress, cows are less likely to show signs of estrus or heat which is related to decreased amounts of blood hormones. Estrus events are shortened and not as intense as during the winter months. Without these visual signals, the farmer doesn’t know that a cow should be bred and when a cow does not get semen in her, the cow cannot conceive a pregnancy.
- Developing follicles and sperm. This decrease in hormones in the blood also prevents the normal development of ova. Without this proper amount of hormones, the cow will experience longer follicular waves and underdeveloped dominant follicles. Additionally, heat stress inhibits sperm development and reduces libido in bulls. Heat stress will cause lower sperm concentrations, lower mobility, and more deformities in the sperm. These service sire effects will decrease the conception rate in a natural serviced herd.
- Embryos can be heat stressed too. An embryo in heat stressed cows can die within 17 days after fertilization because the early embryo does not have proteins that help it combat heat stress. When a cow is heat stressed, the cow’s core body temperature rises. This increased heat inside the body is what affects the embryo and without heat shock proteins, the embryo will die, decreasing pregnancy rate. Heat stress also retards the growth of young follicle which results in the weakening of the signal that tells the cow that she is pregnant. Without this signal from the embryo, the cow will stop secreting the hormones needed to maintain pregnancy.
- The fetus and heat stress. Not only does the cow have fertility issues with heat stress, but the developing fetus can also have fertility issues in the future. Calves from a dam that expressed high levels of heat stress when pregnant are more likely to require more services than calves whose dams had heat abatement systems. Additionally, these calves are born with lower birth and weaning weights and produced less milk in the first lactation.

Managing heat stress: So now that some of the causes are known, how can we minimize the effects of heat stress on reproductive performance?
- Turn on fans and sprinklers. Fans should be turned on around a temperature of 65°F and sprinklers around 70°F. Sprinklers should be located over the feed bunk and in the holding pen, while fans should be located at the feed bunk, in the holding pen, and over every row of free stalls. The sprinkler system should soak the cow for 2 minutes and then is turned off for...
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15 minutes to allow the fans to create a breeze over the cow to evaporate the water and heat. These time intervals change as the temperature humidity index rises. When this happens, the time between when the sprinklers are turned on should be shortened.

- **Synchronization protocols and Timed AI.** Synchronization protocols help with the fact that cows are not showing as strong of heats during heat stress periods. When these programs are used with Timed AI protocols, the need for an observed estrus is taken out of the equation. The use of Timed AI can reduce the number of days open, and interval of calving to first breeding when compared to breeding on observed estrus. These programs can be found on the Dairy Cattle Reproductive Council website. It is important to note that these programs help with estrus detection during heat stress but do not change the effects of heat stress on the oocyte. Cow cooling is need to reduce the effects of heat stress after conception.

- **Embryo transfer.** Another method to prevent embryo death during heat stress periods is to transfer embryos from donor cows which were not heat stressed. Not only can this improve genetics, but it helps to bypass the susceptible stages of the embryo to heat stress. At the point of the transfer into the recipient, the embryo has the proteins needed to fight heat stress. Research shows a $14 to $22 increase in profit from embryo transfer. This range varies based on management of the herd and the cows producing and receiving the embryos.

Heat stress is a major issue dairy farmers must mitigate on dairy farms. Heat stress impairs not only milk production but, reproductive ability as well. It reduces the tendency of estrus and decreases embryo survivability. Simple techniques, such as turning fans and sprinklers on and use of synchronization programs, can help manage for better fertility during times of heat stress.