Do Cattle Need Shade on Pasture?

During the summer months, cattle in Kansas and throughout the Great Plains can experience intense solar radiation, temperatures well over 100 degrees Fahrenheit, and periods with high humidity. These weather factors create conditions in which heat stress and animal welfare become a concern. Animals typically dissipate body heat through their skin into the environment, but when high heat and humidity cause heat stress, heat loss through the skin is difficult. The main way for cattle to dissipate heat is then through evaporation by way of sweating and panting.

Animals unable to reduce their body temperature in the summer have more rapid breathing and panting, increased water intake, and decreased feed intake. Cattle may also have increased cortisol and insulin levels, which are internal signals of stress and affect feed conversion.

Feedlot cattle are especially prone to heat stress because of low soil cover (which allows hot soils to reflect heat back onto animals), higher animal densities, and low mobility (which reduces cooling air movement around animals). Research at the Kansas State University Beef Stocker Unit in Manhattan and at other finishing lots shows that one of the best ways to reduce heat stress in feedlot cattle is to provide shade. Implementing summer shade in confined beef systems lowers the pen soil temperature, lowers body temperature, increases intake, and can improve feed efficiency and gain compared to cattle without shade. The Animal Comfort Index on the Kansas Mesonet (*https://mesonet.k-state.edu/agriculture/animal/*) can indicate when feedlot cattle may be under heat or cold stress.

This information about the benefits of shade for feedlot cattle naturally raises the question, "Do cattle on summer pasture need shade?" The short answer to this question is probably not, but little research has been conducted evaluating the effects of shade on beef production in cattle on pasture. Of the pasture studies conducted, the majority have measured responses to shade using dairy cattle. When pasture shade studies have included beef cattle, most have been conducted in tropical regions with a high potential for heat stress using *Bos indicus* breeds originating from southern Asia, such as Brahman or Nellore cattle, rather than *Bos taurus* breeds originating from Europe, such as Angus or Hereford cattle.

Regardless of the type of cattle used or the study location, the results were highly variable. Some studies found no differences in animal body temperatures or breathing rates with or without shade, while other studies showed that shade reduced some symptoms of heat stress. Most of these studies only measured signs and symptoms and did not measure actual production responses, such as cow or calf gains or conception rates.

With the lack of studies on the Great Plains testing the effects of pasture shade on beef cattle production, it is hard to make a conclusive recommendation. It has been shown that shade may reduce some symptoms of heat stress, but this may not translate into any production benefit in pounds or quality of beef produced in a pasture

Figure 1. Cattle huddled under tree shade during the Kansas summer. Note the weedy vegetation growing around the area disturbed by frequent hoof traffic.

Figure 2. Cattle loafing under shade at midday rather than grazing.

setting. Still, some producers may choose to provide shade for pasture animals to reduce stress for perceived animal welfare purposes, or as required by a verified production program.

If producers decide to provide shade, it is recommended that the shade area be from an artificial or man-made structure that is large enough and has a tall canopy height so that all animals have space around and above their bodies for airflow to maintain a cooling effect. Some producers may wish to use trees for shade, but the encroachment and expansion of trees and shrubs in Great Plains pastures reduces the productivity of existing grasslands and reduces overall grazeable grassland acreage. Trees

Figure 3. Erosion under tree shade near ponds and streams can lead to sedimentation of the water source.

in Kansas native rangelands historically were found only along steep rocky slopes or the edges of continually flowing rivers and streams, places that served as fuel breaks for recurring rangeland fires. The introduction of trees into areas where they were not previously found and the lack of prescribed burning have led to the rapid expansion of tree cover in pastures and the loss of pasture productivity, resulting in fewer pounds of beef per acre. Introducing more trees or allowing trees to increase for shade poses a great threat to the future of Kansas grasslands.

Artificial shade structures on pasture should be designed so that each cow has a shaded area of approximately 80 square feet, and each stocker has 22 square feet of shaded area. This amount of shade provides enough area so that animals are not bunched together, and air can still flow between animals. Most of the benefits of shade to relieve heat stress are lost if animals have to stand too closely together to fit into the shaded area. The structures should also be high enough off the ground (at least 7 to 14 feet tall) that heat is not trapped and reflected down to the animals from the shade structure. Ideally, structures would be mobile so that they can be moved around pastures. Shade structures that are immobile, such as trees, risk trampling, loss of vegetative cover, weedy species encroachment, and erosion beneath and near the stationary shade

Environmental Factors Related to Heat Stress	Shade Effect
Daytime air temperature	None
Nighttime air temperature	None
Solar Radiation	Lower
Relative humidity	None
Wind speed	None
Bare soil temperature	Lower
Distance to water	None

canopy. Shade near ponds or streams can lead to greater accumulations of silt and sediment in the water.

During summer periods of high heat and humidity, a key management practice to sustain production is to allow animals full access to the landscape to find prevailing winds and maintain air flow around their bodies. Grazing animals should also have free access to plenty of fresh, cool drinking water.

Artificial shade structures may also alleviate some signs of heat stress; however, more research into the conditions of Kansas native grazing systems is needed to determine whether shade increases production.

Keith Harmoney, *Range Scientist*
Emma Briggs, *Beef Systems Extension Specialist*
A.J. Tarpoff, *Beef Extension Veterinarian*
Kansas State University

Publications from Kansas State University are available at *bookstore.ksre.k-state.edu*.

Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Director of Extension, Kansas State University, County Extension Councils, Extension Districts. Kansas State University is an equal opportunity provider and employer.

This publication will be made available in an accessible alternative format or in languages other than English upon request. Please contact *ksrenews@k-state.edu* to request translation services.

MF3742 July 2026