The Influence of Radiant Heat Load And Temperature Stress on Bull Growth and Fertility

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Story in Brief

Four yearling bulls (15-18 mo age) were allotted to .4 ha bermudagrass pastures. Two pastures had shades available to the animals at all times. Daily gains were greater .56 vs .44 kg/day for the animals with shade. There were no apparent differences in volume of semen; however, motility of cells, percent live and normal were lowered while aged, abnormal and abnormal non-aged cells were increased in animals without access to shade. There were interactions between weeks and shade availability. Temperatures varied from a low of 26.7 C to a high of 41.7 C with 55 days in which the daily high was above 32.2 C. Results indicate that animals with shade may be better *doers* and maintain higher levels of fertility. Additional shade studies are indicated as necessary.

Introduction

Reproductive efficiency of the male is lowered when exposed to high environmental temperatures. Radiation from the sun during the summer months may reach levels to adversely influence reproductive capacity. Sperm formation and maturation is a continuous process requiring from six to eight weeks in the bovine. Any damage to cells during this process will affect fertility for several weeks.

The purpose of this pilot study was to measure the effects of shade on growth and semen quality of young bulls exposed to summer temperatures.

Experimental Design

Four yearling angus bulls weighing 342 kg were each allotted to .4 ha bermudagrass pastures. Two pastures had shades constructed of pipe and covered with baled straw. The remaining pastures had no shade other than some tall grass along fence lines. A split plot in time with two treatments was used for this study. Animals were rotated among the pastures at three week intervals for the first 12 weeks and remained on the same pasture the last 6 weeks. Abundant forage was available in all pastures during the entire trial.

In cooperation with USDA, Science and Education Administration, Southern Region.

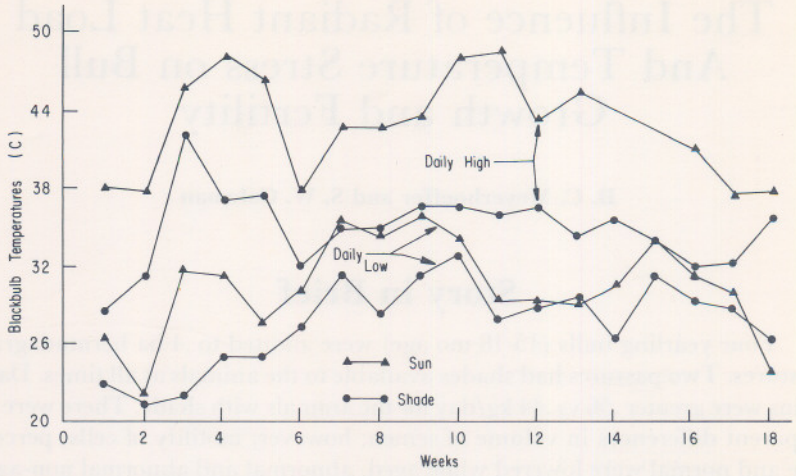

Figure 1. Weekly variation in blackbulb temperatures

The bulls were electroejaculated each week for semen evaluation and weighed at three week intervals. Ambient and blackbulb temperatures in and out of shade were recorded at 2-3 hr intervals daily from 8 am to 5 pm. Continuous ambient temperature, relative humidity and barometric pressure were also recorded near the experimental site.

Results and Discussion

Blackbulb (BB) temperatures (a black sphere, 15.24 cm, with thermometer inserted to its center) are accepted as a measure of sun irradiation effects and heat load. Figure 1 shows a comparison of BB temperatures in the sun and the shade with highs and lows for each week. Daily high blackbulb temperature averaged 42.8 C in the sun and 35.0 C in the shade (significant, $P=.0271$). Weeks and shade × week interaction were also significant ($P<.01$). Daily low BB in shade was also lower than in the sun ($P=.087$) and the interactions between shade × week were again significant ($P<.01$). Daily high ambient temperature averaged 32.9 C in the sun and 31.7 C in the shade ($P=.053$) with peaks much higher as shown in Figure 2.

Daily gains were .56 kg/day *vs* .44 kg/day for animals in shade and no shade pastures respectively. No difference was found in volume of semen collected, but motility steadily decreased reaching a low of 45 percent at 12 weeks for animals without access to shade compared to 82 percent for animals with shade. Figure 3 shows the difference in motility and percent abnormal cells over time. The average motility for bulls with shade was 84 percent *vs* 66.9 percent for those without shade. Abnormal cells were higher during the same time periods that motility was lowest.

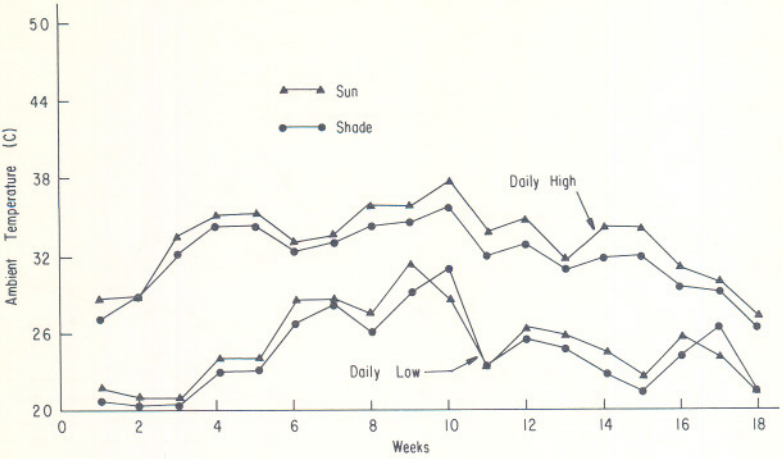

Figure 2. Weekly variation in ambient temperature

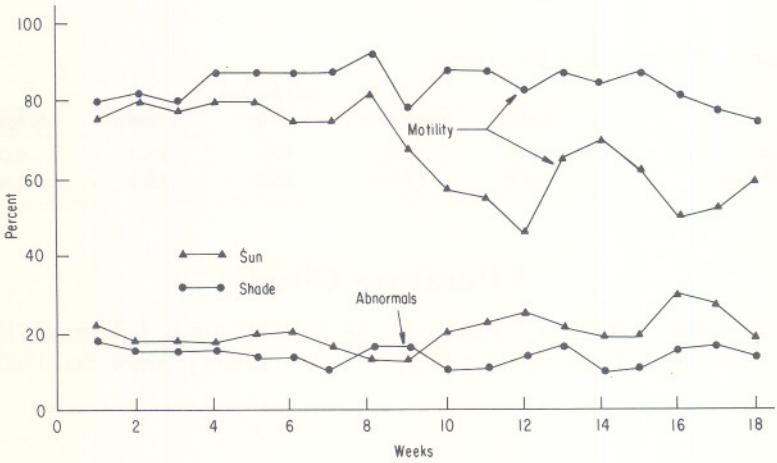

Figure 3. Weekly variation in percent motility and percent abnormal cells

Figure 4 shows the variation in abnormal non-aged and aged cells as affected by availability of shade. Abnormal non-aged cells averaged 25.5 percent in the sun and 13.4 percent in the shade.

Table 1 lists averages for traits from animals with and without shade.

Though significant differences due to availability of shade were not found with the traits which affect motility, the numerical averages indicate a potential biological importance. As illustrated with artificial environments (Meyerhoeffer *et al.*, 1976), approximately 6-8 weeks were required for high temperatures to influence sperm production (Figures 1, 3 and 4).

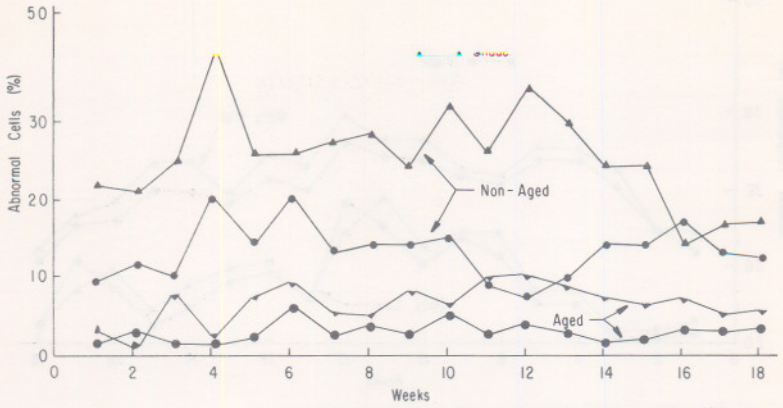

Figure 4. Weekly percent variability of abnormal aged and non-aged cells

Table 1. Semen Traits Compared

	Trait Average				
	Motility	Abnormals	% Live	% Normal	% Aged
Shade	84.0	14.05	82.1	84.1	6.0
No shade	66.9	19.84	68.2	68.2	11.4

Literature Cited

Meyerhoeffer, D. C., R. P. Wettemann, M. E. Wells and E. J. Turman. 1976. Effect of Evelated Ambient Temperature on Bulls. J. Anim. Sci. 43:297.