Relationship of Ambient Temperature, Black Globe Temperature and Humidity to Respiratory Rates in Boars

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Story in Brief

Six Yorkshire boars were maintained with either shade or a shade-sprinkler during the summer of 1979 to determine the relationship of respiratory rate (RR) with ambient temperature, black globe temperature and humidity. RR was not significantly related to any of the measurements in shade-sprinkler boars. However, RR increased 2.9, 4.9 and 12.9 breaths per minute for each unit increase in black globe temperature, ambient temperature and Temperature Humidity Index (THI), respectively. The results indicate that ambient temperature, black globe temperature and THI are all significantly correlated with RR in boars receiving only shade during the summer months in Oklahoma. In addition, either RR, ambient temperature, black globe temperature or THI could be used to determine if boars are cooled adequately to prevent heat stress.

Introduction

Season of the year greatly influences reproductive performance of swine. Exposure of boars to increased ambient temperatures results in reduced semen quality and fertility. If boars are heat stressed during July and August, fertility may be reduced for up to 5 weeks after boars are exposed to a cool environment. Our previous studies have demonstrated that exposure of boars to increased temperatures results in increased respiratory rates (RR) and rectal temperatures.

The purpose of this study was to determine the relationships of ambient temperature, black globe temperature and humidity with RR in boars.

Materials and Methods

Six Yorkshire boars about 8 months of age were used in this experiment during July and August, 1979. Three boars were kept in an outside lot with a shade provided, and the other three boars were in an adjacent lot with a shade and a water sprinkler with wet sand under it.

Three times weekly for 4 weeks, starting on July 18, the following measurements were taken between 1200 and 1300 hr when the boars were at rest: respiratory rate of each boar, ambient temperature in the sun, black globe temperature, wet bulb temperature and dry bulb temperature. The black globe temperature was obtained by recording the temperature in a copper sphere about 5 inches in diameter that had been painted black. The sphere was exposed continuously to direct sunlight.

The temperature-humidity index (THI) was calculated from dry bulb temperature (db, °F) and relative humidity (rh% ÷ 100) obtained between 1200 and 1300 hr using the following formula as described by Ingraham and coworkers (1976):

$$THI = db - (.55 - .55rh)\ (db - 58)$$

The THI takes into account both the temperature and relative humidity the animals are exposed to.

Results and Discussion

The relationships between ambient temperature and respiratory rates (RR) for shade and shade-sprinkler boars are depicted in Figure 1. As might be expected, RR of the shade boars increased at the rate of 4.9 breaths for each degree increase in ambient temperature. However, RR of the shade-sprinkler boars was not influenced by ambient temperature. The summer of 1979 was cooler than usual in Oklahoma, and the maximum ambient temperature recorded during this experiment was 104°F.

Similar to the relationships between ambient temperature and RR, black globe temperature (a measure of radiant energy) was related to RR in shade boars but not in shade-sprinkler boars. RR increased 2.9 breaths per minute for each degree increase in black globe temperature between 88 and 114°F. In this experiment, correlations between RR of shade boars and ambient temperature or black globe temperature were .75 and .59 ($P<.001$), respectively. If animals were exposed to direct sun without shade, the relationship between RR and black globe temperature may be greater than that which was observed in this experiment.

In an attempt to determine the influences of both ambient temperature and relative humidity on RR of boars, the THIs were calculated (Figure 2). THI was related to RR in shade boars, but RR remained constant in shade-sprinkler boars although the THI increased from 76 to 86. RR increased 12.9 breaths per minute in shade boars for each unit increase in THI. The correlation between THI and RR (.80) was slightly but not significantly larger than the correlation between ambient temperature and RR. If we assume that boars with RR greater than 50 breaths per minute may

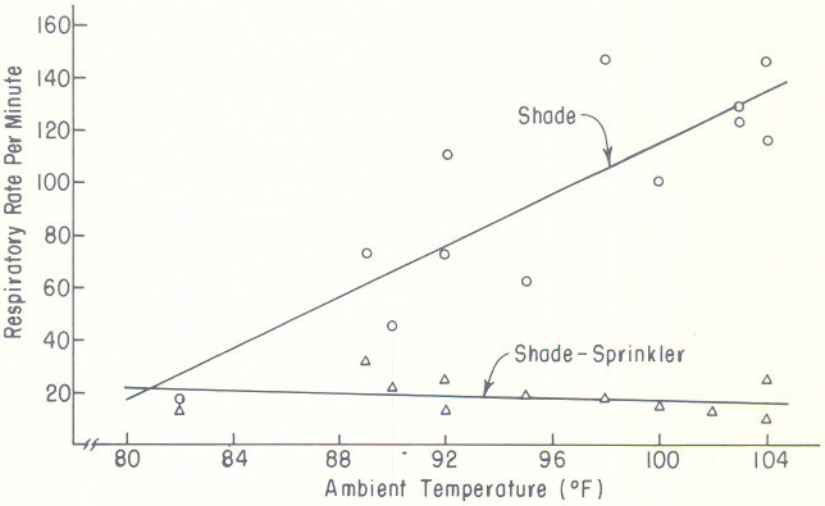

Figure 1. Relationship between respiratory rate and ambient temperature for boars. Each point represents the mean for three boars on one day.

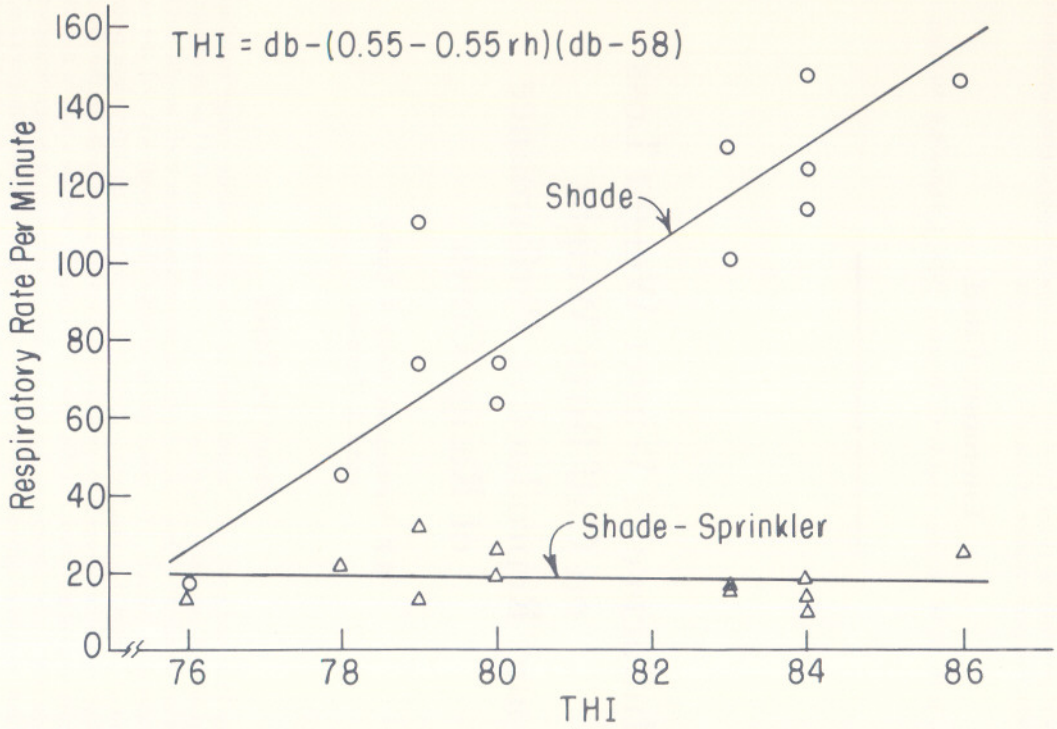

Figure 2. Relationship between respiratory rate and the Temperature Humidity Index for boars. Each point represents the mean for three boars on one day.

have reduced reproductive performance, then cooling should be supplied to shade boars when ambient temperature is greater than 86°F, or black globe temperature is greater than 88°F or the THI is greater than 78.

These data indicate that ambient temperature, black globe temperature and THI are all significantly correlated with RR in boars receiving only shade during July and August in Oklahoma. Furthermore, these data suggest that ambient temperature, black globe temperature, THI or RR could be used to determine when boars are cooled adequately to prevent heat stress. However, the minimal amount of heat stress that will alter reproductive performance of boars is not known.

Literature Cited

Ingraham, R.H., R.W. Stanley and W.C. Wagner. 1976. J. Dairy Sci. 59:2086.

Influence of Winter Weight Loss on Calf Birth Weight and Reproductive Performance of Range Cows

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Story in Brief

Eighty Hereford cows were maintained in two groups under range conditions. One group of cows (moderate level) was given suplemental feed (41 percent protein cottonseed meal pellets) so that only 3.5 percent of the November body weight was lost prior to calving in March. The other group of cows (low level) was fed the same supplement at a level that resulted in a loss of 14 percent of the fall weight prior to calving. Body condition scores were similar in November and March for the cows on the moderate level of nutrition but decreased 1.7 units for the cows on low nutrition. Birth weight of the calves from cows on the low level of nutrition was significantly less than the birth weight of calves from moderate cows. During the breeding season, 20 percent more of the cows on the moderate level of nutrition exhibited estrus by 80 days postpartum compared to the cows on low nutrition. Pregnancy rate for the moderate cows was 85 percent, compared to only 71 percent for the cows on the low level of winter nutrition.