Journal of Animal and Veterinary Advances 9 (13): 1824-1827, 2010
ISSN: 1680-5593

Determination of Critical Period for Dairy Cows Using Temperature Humidity Index

Adil Akyuz, Sedat Boyaci and Ali Cayli
Department of Farm Structures and Irrigation Science,
Kahramanmaras Sutcu Imam University, Kahramanmaras, Turkey

Abstract: The aim of this study was carried out to determine the critical periods of year for dairy cows using the temperature humidity index. The 30 dairy cows were housed in tie-stall barns in Kahramanmaras, Turkey. The dairy cows slightly experienced the heat stress during time from mid May and the end of October. Farmers should take measurements when the THI is above 72 during the summer months to prevent the losses in milk production and changes in milk composition, milk somatic cell counts and mastitis frequencies.

Key words: Dairy cows, heat stress, temperature humidity index, Tie-stall barn, mediterranean area, critical period

INTRODUCTION

Heat stress has adverse effects on milk production and reproduction of dairy cattle (Kadzere *et al*., 2002; West, 2003; Hansen, 2007). A variety of indices were used to estimate the degree of heat stress affecting cattle and other animals. The most common and appropriate measurement of heat stress for dairy cows is the Temperature-Humidity Index (THI).

It accounts for the combined effects of environmental temperature and relative humidity and is a useful and easy way to assess the risk of heat stress. Generally, mild heat stress is considered to begin at a THI of 72 for cattle with stress increasing to moderate levels at 79 and severe levels at 89. However, there is very little research data available that is specific to dairy cows in Kahramanmaras, In Turkey. The aim of this study was carried out to determine the critical period of year for dairy cows using the temperature humidity index.

MATERIALS AND METHODS

The 30 dairy cows were housed in tie-stall barns in Kahramanmaras, Turkey. In this study 4 humidity sensors and 12 temperature sensors were used in barn and 1 humidity sensor and 1 temperature sensor outside of barn.

The measurement of humidity and temperature of inside and outside of barn were carried out at three different time points of a day (7.00 am, 14.00 pm and 21.00 pm) through the year to estimate the temperature humidity index for inside and outside of barn in Kahramanmaras in Turkey using data logger with sensors.

Temperature Humidity Index (THI) was calculated using the equation as follow. THI = (Dry-Bulb Temperature,°C)+(0.36 Dew point Temperature,°C)+41.2) (Yousef, 1985). Generally, mild heat stress is considered to begin at a THI of 72 for cattle with stress increasing to moderate levels at 79 and severe levels at 89.

RESULTS AND DISCUSSION

The estimated THI values obtained at three different time points of a day (07.00 am, 14.00 and 21.00 pm) for inside and outside of barn on a monthly base are shown in Fig. 1. As can be shown from Fig. 1 THI values at 14.00 pm in January, February, March-April, November and December were <72 whereas THI values at 14.00 pm obtained in June, July, August and September were >72.

Milk production is not affected by heat stress when mean THI values are between 35 and 72 (Johnson, 1985; Du Preez *et al*., 1990a). However, milk production and feed intake begin to decline when THI reaches 72 and continue to decline sharply at a THI value of 76 or greater (Johnson, 1985). Milk yield decreases of 10-40% have been reported for Holstein cows during the summer as compared to the winter (Du Preez *et al*., 1990b).

Moreover, heat stress is associated with changes in milk composition, milk Somatic Cell Counts (SCC) and mastitis frequencies (Rodriguez *et al*., 1985; Nickerson, 1987; Du Preez *et al*., 1990b). It was also suggested that as the THI values increased from 68-78, dry matter intake decreased by 1.73 kg and milk production by 4 kg under Mediterranean climatic conditions. Management strategies are needed to minimize heat stress and attain optimal animal productivity (Bouraoui *et al*., 2002).

Corresponding Author: Adil Akyuz, Department of Farm Structures and Irrigation Science, Kahramanmaras Sutcu Imam University, Kahramanmaras, Turkey

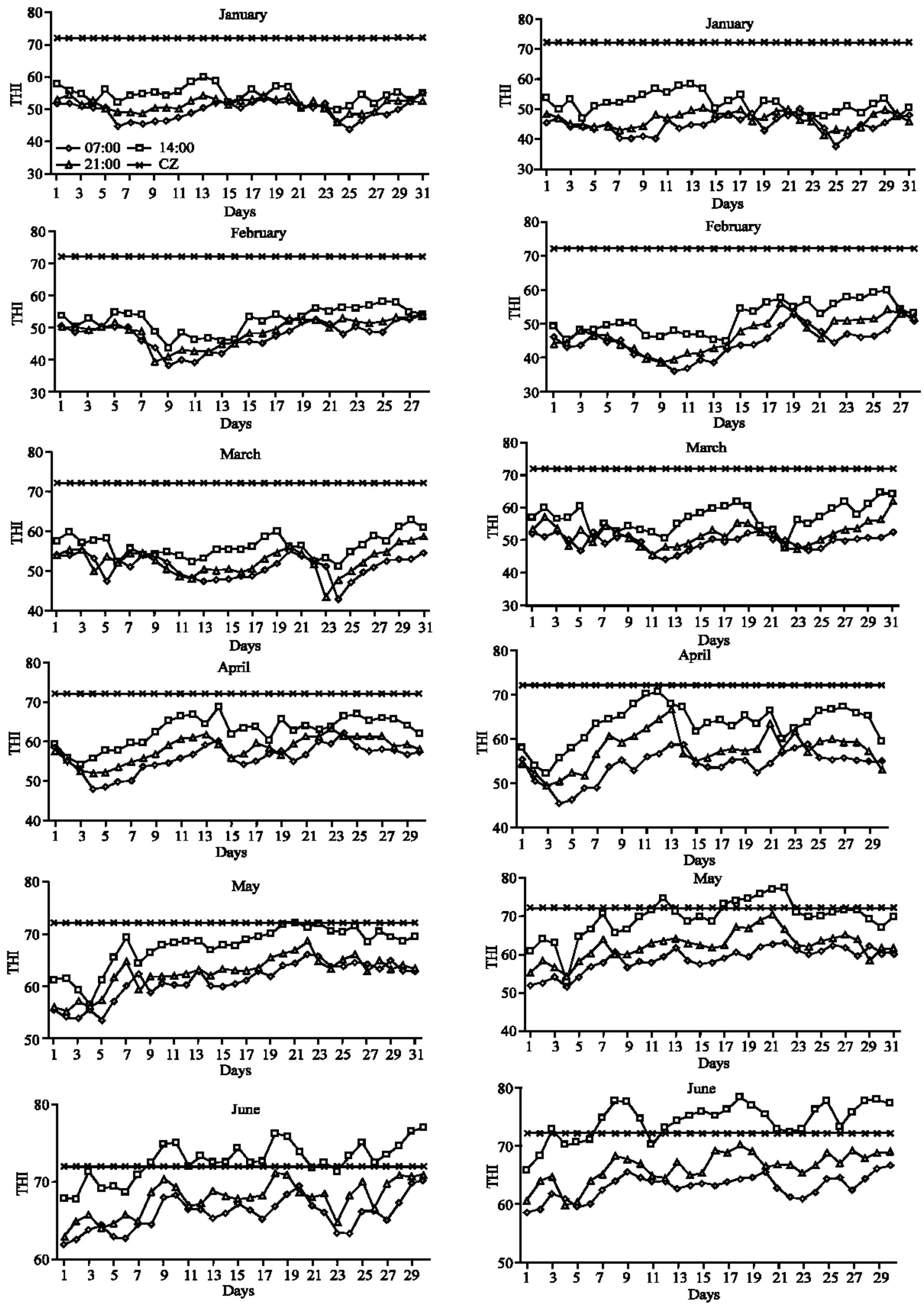

Fig. 1: Continue

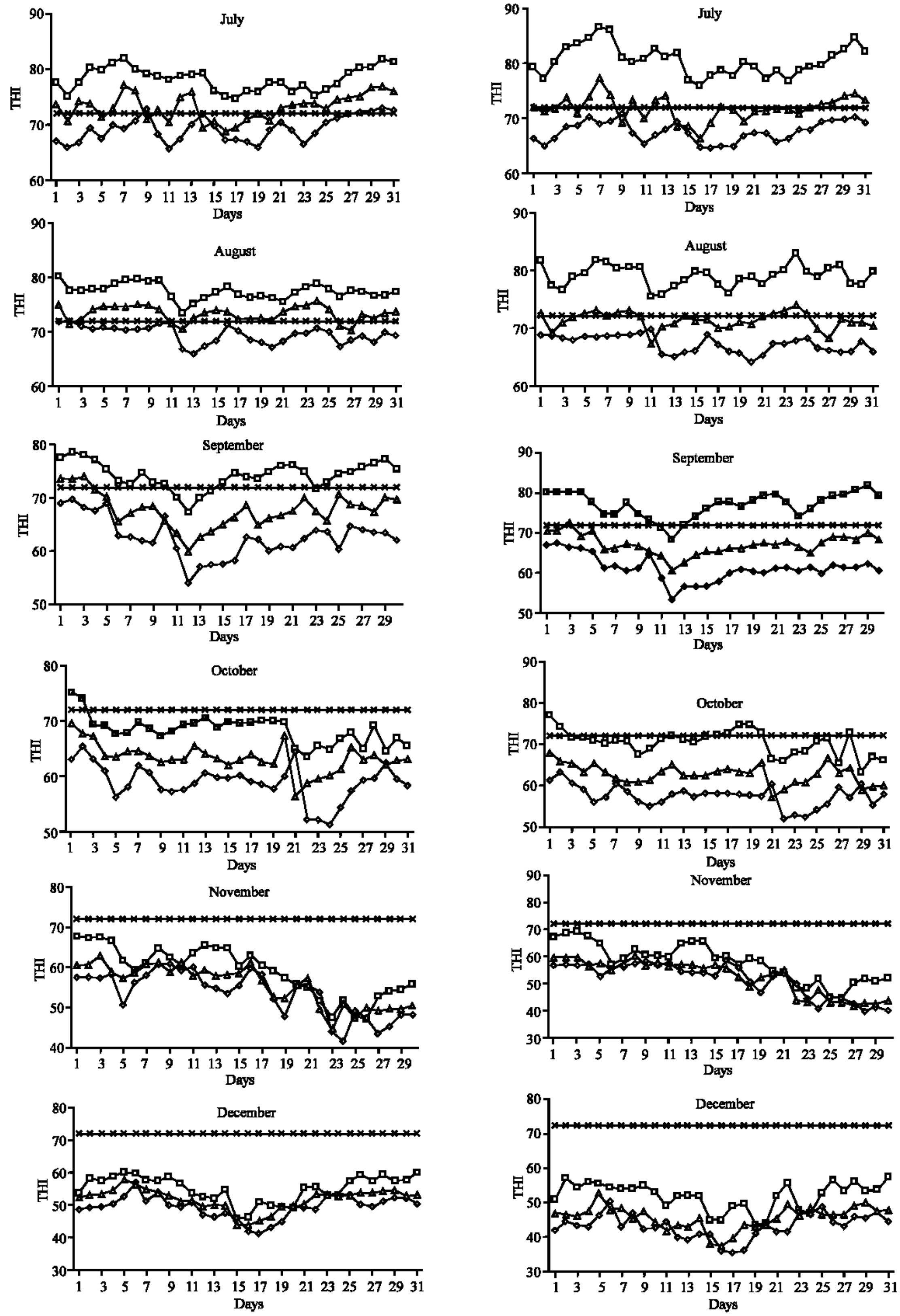

Fig. 1: Temperature humidity index obtained at 07.00 am, 14.00 and 21.00 pm for inside and outside of barn on a monthly base

Therefore, it is likely that the losses in the milk production and changes in milk composition, milk somatic cell counts and mastitis frequencies are inevitable during the mid may, June, July, August and September due to increase in THI. Therefore, farmers should take measurements when the THI is above 72 during the summer months to prevent the losses in milk production and changes in milk composition, milk somatic cell counts and mastitis frequencies.

There are several strategies were suggested to alleviate the heat stress to maintain or increase the productivity. One strategy used to minimize effects of heat stress is to modify the environment in which cows are kept by providing shade to reduce solar radiation or using sprinklers to increase evaporative cooling. Manipulation of certain diet ingredients is another strategy that may be beneficial (Knapp and Grumyea, 1991). Decreasing fiber intake within limits of maintaining adequate fiber levels for proper rumen function can be effective in partially alleviating heat stress (Cummins, 1992).

CONCLUSION

Farmers should take measurements when the THI is above 72 in June, July, August and September to prevent the losses in milk production and changes in milk composition, milk somatic cell counts and mastitis frequencies.

REFERENCES

Bouraoui, R., M. Lahmar, A. Majdoub, M. Djemali and R. Belyea, 2002. The relationship of temperature-humidity index with milk production of dairy cows in a Mediterranean climate. Anim. Res., 51: 479-491.

Cummins, K.A., 1992. Effect of dietary acid detergent fiber on responses to high environmental temperature. J. Dairy Sci., 75: 1465-1471.

Du Preez, J.H., P.J. Hatting, W.H. Giesecke and B.E. Eisenberg, 1990a. Heat stress in dairy cattle and other livestock under Southern African conditions. III. Monthly temperature-humidity index mean values and their significance in the performance of dairy cattle. Onderstepoort J. Vet. Res., 57: 243-248.

Du Preez, J.H., W.H. Giesecke and P.J. Hattingh, 1990b. Heat stress in dairy cattle and other livestock under Southern African conditions. I. Temperature-humidity index mean values during the four main seasons. Onderstepoort J. Vet. Res., 57: 77-87.

Hansen, P.J., 2007. Exploitation of genetic and physiological determinants of embryonic resistance to elevated temperature to improve embryonic survival in dairy cattle during heat stress. Theriogenology, 68: S242-S249.

Johnson, H.D., 1985. Physiological Responses and Productivity of Cattle. In: Stres Physiology in Livestock, Yousef, M.K. (Ed.). CRC Press, Boca Raton, Florida, ISBN: 0849356679.

Kadzere, C.T., M.R. Murphy, N. Silanikove and E. Maltz, 2002. Heat stress in lactating dairy cows: A review. Livest. Prod. Sci., 77: 59-91.

Knapp, D.M. and R.R. Grumyea, 1991. Response of lactating dairy cows to fat supplementation during heat stress. J. Dairy Sci., 74: 2573-2579.

Nickerson, S.C., 1987. Mastitis management under hot, humid conditions. Proceeding of the Dairy Herd Management Conference, Feb. 9-11, Macon, GA, pp: 32-38.

Rodriguez, L.A., G. Mekkonen, C.J. Wilcox, F.G. Martin and W.A. Crooned, 1985. Effect of relative humidity, maximum and minimum temperature, pregnancy and stage of lactation on milk composition and yield. J. Dairy Sci., 68: 973-978.

West, J.W., 2003. Effects of heat-stress on production in dairy cattle. J. Dairy Sci., 86: 2131-2144.

Yousef, M.K., 1985. Stress Physiology in Livestock. 1st Edn., CRC Press, Boca Raton, FL., ISBN: 0849356679, pp: 1-217.