Effect of Caloric Stress on Milk Production and Animal Comfort

Mónica B. Sacido
Universidad Nacional del Centro de la Provincia de Buenos Aires, Argentina

F. Loholaberry
Universidad Nacional del Centro de la Provincia de Buenos Aires, Argentina

N. Sánchez
Universidad Nacional del Centro de la Provincia de Buenos Aires, Argentina

J. Intruvini
Universidad Nacional del Centro de la Provincia de Buenos Aires, Argentina

ID # 10-03

EFFECT OF CALORIC STRESS ON MILK PRODUCTION AND ANIMAL COMFORT

M. Sacido[1], F.Loholaberry[1], N. Sánchez[1] and J. Intruvini[1]

[1]Department of Vegetal Production, Facultad de Agronomía, Universidad Nacional del Centro de la Pcia. de Buenos Aires, C.C. 47, Azul (7300), Argentina, msacido@faa.unicen.edu.ar

Abstract

The objective of this study was to determine the effect of the environmental factors on the animal behaviour of grazing dairy cows, estimated through the THI (Temperature-Humidity Index) and the relationship with the daily milk production, quality of milk, consumption and the detection of zeal. The study was carried out in Azul , in the province of Buenos Aires, Argentina and was developed from December 1999 to February 2000. The effect of the half shade was quantified based on the production in litres of milk/day, % protein, % fat and detection of zeal. In the period analyzed, the THI usually surpassed the values tolerated by the animal, generating different stress levels that were attenuated with artificial shades.

Keywords: Dairy cows, caloric stress, comfort, behaviour, animal performance, THI

Introduction

In the systems of production of dairy farm in Argentina, the animals are exposed to the environment whose characteristics affect as much the physiologic responses as the productive ones. The dairy cattle come from the north of Europe. They are animals adapted to cold climate,

that is why they tolerate high temperatures and high humidity with difficulty. The temperature of the air that surrounds an animals is extremely important to determine the degree of comfort. At a temperature above 25 ºC the cow reduces voluntarily its intake of water and food, which generates a decrease in the production and the quality of the milk (Bucklin et al., 1991, Harris et al., 1991).

As environmental temperature and the relative humidity increase, the loss of heat of the cow diminishes and its corporal temperature increases, reaching the thermal stress (temperature of > 25ºC and humidity to > 50%). To evaluate the environmental impact on the comfort, the THI (Temperature-Humidity Index) is used i.e. the relationship between the temperature and humidity. This relationship causes a condition that affects directly the animal and their production and it is considered that at THI higher than 72, the animals would begin to suffer stress (Hahn, 1985, 1993). It is also very important to determine the number of hours of stress along the day and the number of days.

To improve their comfort, the animals can move towards the wind, looking for a fresh or humid place, they reduce their food consumption, in order to increase the consumption of liquid and to look for natural or artificial shades (Hahn et al. 1993).

These mechanisms are necessary to maintain the normal operations of the body, but they have a negative impact on milk production, presenting reductions between 10 and 20%, with a marked decrease in the content of solids, especially fat and protein. There is also a higher number of somatic cells and more frequent cases of mastitis can take place. The reproductive efficiency can also be affected and in critical situations the indices can reach 20% of conception rate.

The most productive, mature and heaviest animals are more susceptible to the problems related with the heat.

The objective of this study was to determine the effect of the environmental factors on animal behaviour of grazing dairy cows, estimated through the ITH and the relationship with the daily milk production, quality of milk, consumption and the detection of zeal.

Material and Method

The study was carried out in Azul (36.1º-37.3ºS 59º-12ºW), in the province of Buenos Aires, Argentina, about 132 m above sea level, with warm climate, with a rainfall mean of 900 mm.

The experiment was developed from December 1999 to February of 2000. The climatic conditions during the trial were registered between 12 a.m. and 6 p.m., every hour, by two meteorological stations that were in the field, under the half shade and out of it (temperatures and relative humidity).

For the experiment a mesh of half shade of 80% was used, that i. e. that it lets through only 20% of the solar light, and it was placed 3 m from the ground. Each animal had 2 m2 of shade and a watery under the half shade.

The animals were milked to the 4 a.m. and 4 p.m., they were fed on a diet composed by sorghum grazing (*Sudan grass)* 8.28 KG MS/VO/day, Red Clover (*Trifolium pratense L.*) 3.76 KG MS/VO/day, Corn grain (*Zea mays L.*) 3,6 KG MS/VO/day. The total of the offer was 15.64 KG MS/VO/day, that represented a contribution of 37.02 Mcal EM/VO/day and 1,424 Kg PM/VO/day.

The heard of 317 dairy cows, had an average daily milk production of 16 liters.

The treatments were T1 (under the half shade) and T2 (outside).

Animal behaviour was observed throughout the day and month, and relation with the THI schedule, everyday and monthly and the time of day grazing.

The effect of the half shade was quantified based on milk production and composition and detection of zeal.

Data were submitted to analysis of variance and means were compared by Tukey's test at an alpha level of 0.05.

Results and Discussion

From December to February the animals suffered different stress levels, with THI values higher than 72 during most of the days, in January (Table 1). The stress conditions took place in every measured schedule, generating an accumulative effect that can be related to the decrease in milk production in that period.

-Variation in the milk production:

After 4 days of temperature higher than 30 ºC, the herd milk production decreased 10% and was more evident (30%), in the cows that were in the first lactacting third and were producing more than 23 l/day. It was also observed a decrease in fat milk percentage from 3.6% to 3.2%, while the protein level decreased from 3.34 % to 3.00 %.

-Change in the grazing pattern:

When the THI was above 72, the cows stopped consuming to take refuge under the half shade and near the water, although the half shade did not affect the temperature of the air, but it reduced the caloric radiation and allowed for improvement in comfort since they had cool ground to rest.

-Effect on the detection of zeal:

During the period December - February a suspension was observed in the detection of zeal from the 1/01/00 to the 22/01/00, which coincided with days when the measured THI reached values of 82 (severe stress), this is due to the stress since heat does not influence the cow

cycle, but the cycle of zeal shortens between 10 a.m. and 6 a.m., and the intensity of the demonstrative behaviours of the zeal decreased. Due to these factors, the detection of their zeals blocked, affecting the indices of pregnancy and generating a delay in the milk production.

In the study area and period analyzed December-February 2000, the THI usually surpassed the values tolerated by the animal, generating different levels of stress that were attenuated with artificial shades.

References

Bucklin, R.A., Turner L.W., Beede D.K., Bray D.R. and Hemken R.W. (1991). Methods to relief heat stress for dairy cows in hot, humid climates. Applied Engineering in Agric**. 7**: 241.

Hahn, G.L. (1985). Management and housing of farm animals in hot environments. Chapter 11 In: Stress Physiology in Livestock, volume II, Ungulates. Edited by M.K. Yousef. CTC Press, /Boca Ratón, FL p. 151.

Hahn, G.L., Nienaber J.A. and Eigenberg R.A. (1993). Environmental influences on the dynamics of thermoregulation and feeding behavior in cattle and swine. Proc 4th Int'L. Lvstk. Environm. Symp. :1106-1116. Amer. Soc. Agric. Engrs., ST. Joseph, MI.

Hahn, G.L. and Huska R.L. (1993). Bioclimatologia and Facilities Zootecnicas Workshop Brasileiro of Animal Bioclimatologia. Jaboticabal, SP. P. 28.

Table 1 – Temperature-humidity index values observed on different days and hours of the day from December to February

STRESS LEVEL	DECEMBER			JANUARY			FEBRUARY		
	12 a.m.	3 p.m.	6 p.m.	12 a.m.	3 p.m.	6 p.m.	12 a.m.	3 p.m.	6 p.m.
THI<72	13	13	13	6	2	2	5	3	3
THI 72-74	6	4	3	3	3	3	4	1	-
THI 74-76	5	4	5	6	2	2	1	3	2
THI 76-78	7	10	10	16	24	24	4	7	4

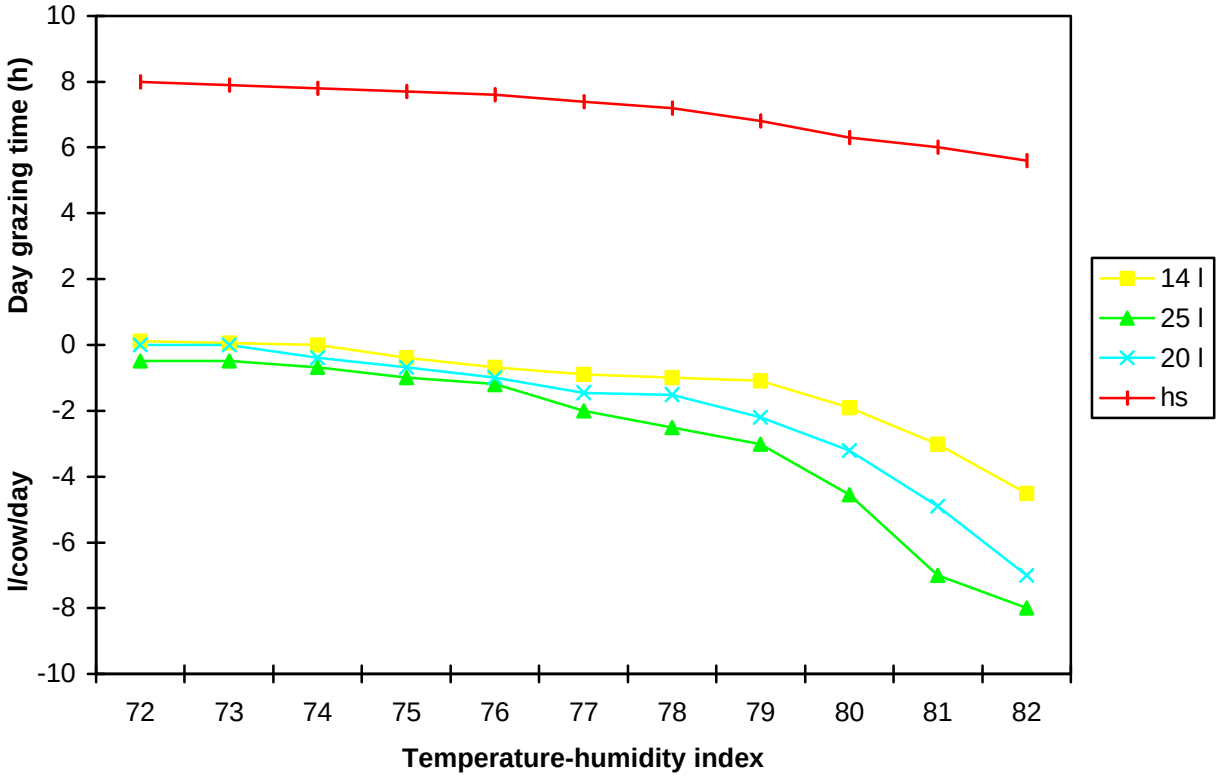

Figure 1 – Variation in milk yield as affected by temperature–humidity index and cows production level: 14 L (—■—); 20 L (—x—); 25 L (—π—).