THE EFFECT OF HIGH TEMPERATURES ON THE YIELD OF MILK, FAT AND PROTEIN OF UKRAINIAN HOLSTEIN

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Introduction. In the context of global environmental change, great attention from dairy professionals is aimed to prevent the harmful effects of high temperatures on a health and productivity of animals. This problem is relevant to the regions of the planet with a moderate and hot climate, including Central and Eastern European countries, which could lead to significant economic losses. However, despite a comprehensive study of the effect of heat on an organism of dairy cattle, most of the domestic publications are devoted directly to the consideration of only the effect of high temperature as the determining factor that leads to a change in the physiology and productivity of milk cows. That one-sided approach to assessing the impact of the environment on a body does not fully allow take into account the influence of all its components. According to an overwhelming majority of scientists, the emergency of heat stress is associated with both the impact of increased temperature in a surrounding environment on an organism and relative air humidity that may enhance the effect of heat. Therefore, the temperature-humidity index (THI) is a common indicator of the evaluation of this type of stress [1, p. 260; 2, p. 109; 3; 4, p. 97].

The purpose of our research was to study the effect of high temperatures on milk yield, milk fat and protein yield in Ukrainian Holstein cows, and the possibility of using a temperature-humidity index to assess the effect of heat on the productivity of dairy cattle.

Material and methods. Studies were conducted in 2017 in the conditions of a breeding farm for maintenance of animals Holstein breed Private JSC "Agro-Soyuz" in the

Dnipropetrovs'k region. Studies were on the data of the dairy cattle management system "Orsek". Biometric processing was carried out with the help of the Stat Soft software "STATISTICA 10". The equation (1) was used to calculate the temperature-humidity index:

$$THI = 1{,}8 \times Tdb - \left(1 - RH/100\right) \times \left(Tdb - 14{,}3\right) + 32 \quad (1),$$

where Tdb – dry bulb temperature;

RH – relative humidity;

THI – temperature-humidity index.

It was believed that the THI value below 68 corresponds to the comfortable conditions for animals and that is the limit above which they are exposed to heat stress. Therefore, the value of THI at a level 68 to 71 corresponds to a low stress, between 72 and 79 is a moderate stress, whereas at 80-89 the cows are in a state of strong, and 90-99 - very strong (severe) stress.

Results of the study. Monitoring of the condition of the environment by temperature and humidity indicators was carried out daily in terms of temperature and humidity indicators daily from May to September inclusive according to the nearest meteorological station (Pavlograd). The temperature and humidity were taken into account every hour from 9 to 23 hours. Since the value of THI for animals was more comfortable in May (Figure 1), therefore, changes in the indicators relating to the dairy productivity of cows in the hot summer period was compared with this month.

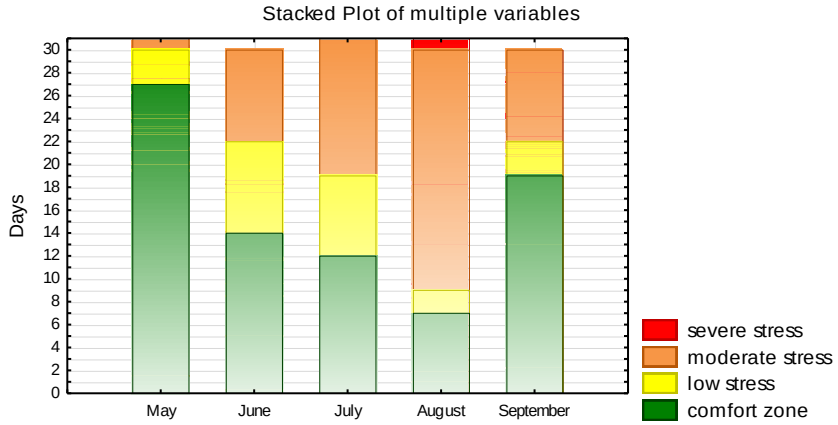

Fig. 1. The state of the environment in accordance with the values of the temperature-humidity index

The results of the study indicate that the Holsteins of Ukrainian breeding with low productivity (22-24 kg) did not react in reducing daily milk yield in June-July, even with the maximum increase in THI to 71.3-72.6 (Figure 2). Only in August (at medium temperature +31.1 °C), with a rise in THI to 75.8 milk yields decreased by 0.4 kg or 1.7% ($P<0.01$). At the same time, it was also lower in September than in May - by 0.3 kg or 1.3% ($P<0.01$), which is apparently due to the aftereffect of high temperatures in August.

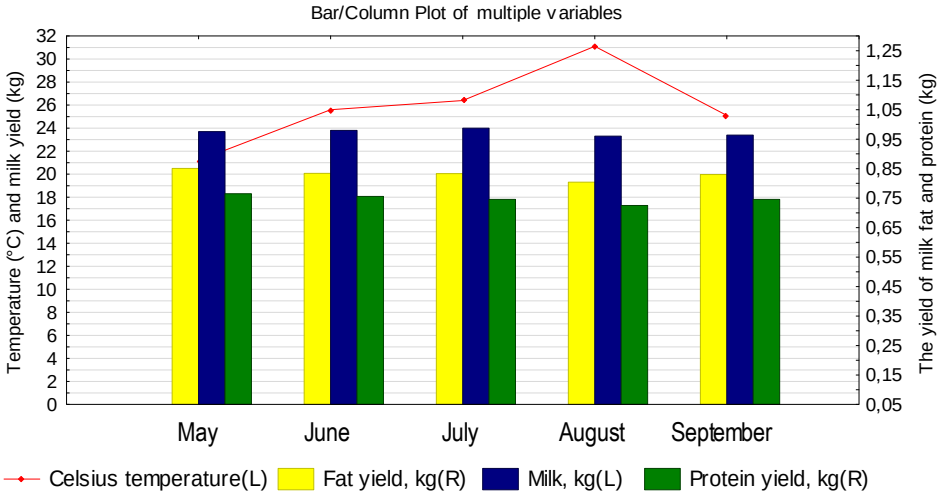

Fig. 2. Dynamics of dairy productivity of Holstein cows in the warm period of the year

However, it should be noted that the yield of milk fat and protein was more likely to be affected by high temperatures. In comparison with May, these indicators decreased by 2.0 (P <0.05) and 1.2%, in July - by 2.1 and 2.5% (P <0.05), in August - by 2.5 and 5.2% (P <0.01) and in September - by 2.5 and 2.5 (P <0.05). The correlation between the air temperature in the daytime in hat area were was barn (at the time of maximum heating at 15 hours) and daily milk yield, the yield of milk fat and protein was negative of average strength r =-0.17-0.34 (P <0.05). At the same time, the yield of cows, the yield of milk fat and protein were determined by the variability of the temperature-humidity state of the environment by 3.0-11.3% (Table 1).

Table 1

Correlation between parameters of the air environment and productivity of Holstein cows

Attribute	Milk, kg		Fat yield, kg		Protein yield, kg	
	r	***R^2, %***	***r***	***R^2, %***	***r***	***R^2, %***
Temperature (average)	-0.08	0.7	-0.36*	12.8	-0.28*	7.7
Relative humidity (average)	0.29*	8.4	0.09	0.09	0.03	0.1
THI (average)	-0.01	0.004	-0.35*	11.9	-0.27*	7.4
Temperature (at 15 o'clock)	-0.17*	3.0	-0.34*	11.3	-0.27*	7.2
Relative humidity (at 15 o'clock)	0.32*	10.2	0.05	0.02	-0.01	0.02
THI (at 15 o'clock)	-0.07	0.4	-0.34*	11.4	-0.24*	5.9

A connection between the THI and the yield of milk fat and protein was also a significant negative average force (r = -0.24 ... -0.34), with low values of the determination coefficient (R^2 = 5.9-11.4%).

Thus, high ambient temperatures in the warm period of the year had a significant impact on fat and protein content in milk than on the daily yield of Holstein cows with low productivity. A reliable negative correlation of the average strength between the temperature and humidity conditions of the environment and the productivity of dairy cows testifies to the possibility of using them in assessing the effect of heat stress on productivity of dairy cattle.

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