The influence of technology housing with regard to thermal comfort

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Abstract: The thermal state of environment is the most important- from the basic components affecting the welfare of animals housed. The thermal state of environment consists of air temperature, relative humidity, air velocity and effective temperature of the surrounding surfaces. The overall effect of these four components under normal conditions significantly influences feed consumption and their use in production. Factors affecting thermal comfort organism can significantly affect the thermoregulatory mechanisms, conversion of nutrients, the performance and health of the animals. Temperature is the main climatic factor that drives the organism of animals with a constant body temperature in order to adapt the production and distribution of heat environmental status, which in extreme cases can affect performance, or even animal health. Heat stress is a major cause of the decline in milk production and fertility, especially in high-yield dairy cows. The best indicator of physiological response to stress is body temperature, since under non-stressed conditions, is nearly constant. The aim of this study was to evaluate the influence of selected housing technology for thermal comfort of the animals housed. In selected groups of cows and heifers was measured rectal temperature and given in relation to the ambient temperature. It was examined how high the temperature effect on the body, what is their impact on heat stress and how it is influenced by the average yield of dairy cows and heifers. In the case of this experiment, it was found that the effect of high temperatures during the summer months, which ranged up to around 26.4 ° C, there was no significant decrease in the average yield of animals.

Key-Words: temperature, feed consumption, production, animal health, heat stress, thermal comfort, dairy cows

Introduction

In environments with high temperatures occur in fattening cattle and especially cows to reduce feed intake, resulting in a decrease in performance [1]. With increasing efficiency, increasing body frame, but also with the growing tendency of a tropical summer days, the phenomenon of heat stress in cattle is becoming an important factor for maintaining a stable yield, but also the health and reproduction of the herd [2]. According to Broucek [3] hot weather causes heat stress in dairy cows, which leads to a decrease in milk production. Higher temperatures are manifested in cattle adversely, especially a decrease in performance, changing the composition of milk (fat content decreases) and a decrease in feed consumption [4, 5, 6]. The consumption of drinking water rises [7]. High-yield dairy cows are the most affected category in cattle [8]. Milk yield of dairy cows is influenced by many internal and external factors. Stable microclimate is undoubtedly one of the important external factors, since it has a significant impact on well-being (welfare) housed animals. Only the cow, which has ideal conditions and welfare and is nothing further stressed can (within their physiological options) to bring maximum performance [9]. For animal products like milk and meat, the conditions in which animals are reared and slaughtered are of prime importance [10, 11]. Individual kinds of animals react to create a suitable microclimate conditions differently. in dairy cows is to increase milk production, fattening improves feed intake and therefore are even higher weight gain [12]. Beede a Collier [13] identified three management strategies to minimize the effects of heat stress: 1) physical modification of the effects of the environment (shading, cooling), 2) genetic development of heat-tolerant breeds, and 3) improved nutritional management practices. Adaptation and acclimatization to heat is more difficult than adaptation and acclimatization to cold. It is easier to increase the production of heat, especially if there is enough food, than to reduce the production of heat by metabolic processes necessary to sustain life [14,15]. In both the heat and cold, homeothermic animals utilize autonomic and

behavioral responses to regulate their body temperature (i.e. thermoregulation) [16]. The cattle generally belongs to animals with very good thermoregulation abilities. Yet ruminants are able to maintain strict homeothermic. In the case of very significant effect of heat stress in cattle the body temperature may fluctuate by up to 3 ° C [2]. The importance of optimal temperatures can be seen in the optimum conversion of nutrients. When temperatures are below the lower boundary optima, affects mainly by reducing the conversion of nutrients, or the next drop increases by reducing disruption to health. On increasing the temperature above the upper limit of the optimum occurs primarily to a reduction in feed intake, body to prevent overheating mainly by evaporation (mainly breathing), a further rise in temperature leads to overheating [17]. The best indicator of physiological response to stress is the body temperature, since under non-stressed conditions, is nearly constant. On the basis of the changes is the fastest way to deduce the thermal load on the body and on the involvement of adaptive mechanisms [18].

Material and Methods

This experiment was carried out in the period from July 2013 to August 2014th. Measurements were carried out in the agricultural cooperative Petrovice. There were selected two groups of cows and heifers. First group consisted of cows and heifers from day to two months after calving, at the beginning of lactation. The second group consisted of cows and heifers in seven to eight months after calving, just prior to hooking. This experiment was conducted in the stable, where the measured cows and heifers were fixed in boxing. First group of cows and heifers was in the barn with different microclimatic conditions than those in the stable, where they were placed cows and heifers from the second group. Rectal temperature was measured using a digital rectal thermometer in selected animals. The rectal temperature was also given in correlation with ambient temperature, which was sensed by a thermal TESTO 425 anemometer with permanently attached thermal probe. Operating temperature of this unit is in a range from -20 to +50 ° C and the probe measuring range is from -20 to +70 ° C. The probe is measured with an accuracy of ± 0.5 ° C and 0.1 ° C resolution. From an agricultural cooperative Petrovice was obtained data on the average performance of dairy cows and heifers for each month and monthly need for raw materials in tonnes (Table 1). The resulting values are summarized in graphs using Microsoft Excel.

Table 1 Monthly raw materials needed in tonnes

Hay	300	Alkalage	252
Alfalfa haylage	2520	Maize silage	5040
Grass silage	1680	Extruded corn grain	132
GPS (a mixed bag wheat with peas)	960	EKPO (waste in the production of confectionery)	72
Fresh dregs	960	A mixture of dairy cows (Preparation for childbirth)	66
CCM (wet corn grain)	300	A mixture of calves	120
A mixture of dairy cow (lactation)	1500	A mixture of dairy cows (rozdoj)	144
molasses	144	cut straw	96

Source: Agricultural cooperative Petrovice

Results and Discussion

The results of correlation rectal temperature of each group of dairy cows and heifers with environmental temperature and yields are shown in graphs 1 and 2. The average rectal temperature measured with animals ranged between 37-38.5°C. Literature gives a range of rectal temperature in cattle 37.5 to 39.5°C. [19] states based on the actual measurement of fluctuations in rectal temperature in dairy cows from 36.9 to 39.1°C. According to [8] temperatures above 39.5°C are already considered as a response to high temperature environments.

The highest values, the average rectal temperature was in the summer, when they were measured also in high temperature air. According to [14] as the threshold temperature, considered to be to heat stress, is usually considered to be 20°C. Regarding the effect of high temperatures on the welfare of

dairy cows, for example [20] argues that in the interval 16-21°C there is no significant changes in production performance, animal behavior and the quality of their products. Likewise [21] indicate that dairy cows thermoneutral zone is placed in the range of -5 to + 24°C, and for high-yield cows are moved to the upper limit of 21°C. Increased heat stress induces behavioral and physiological responses including increased body temperature and respiration reduction in the activity, food intake and milk production. Considerable differences in the measured values of rectal temperatures, especially in summer, are found in the second group of cows and heifers. In this group were in dairy cows and heifers with the highest degree of lactation compared to the previous group, therefore fluctuations were most pronounced in rectal temperature values.

Fig. 1 Effect of temperature on the average performance at first group of dairy cows and heifers

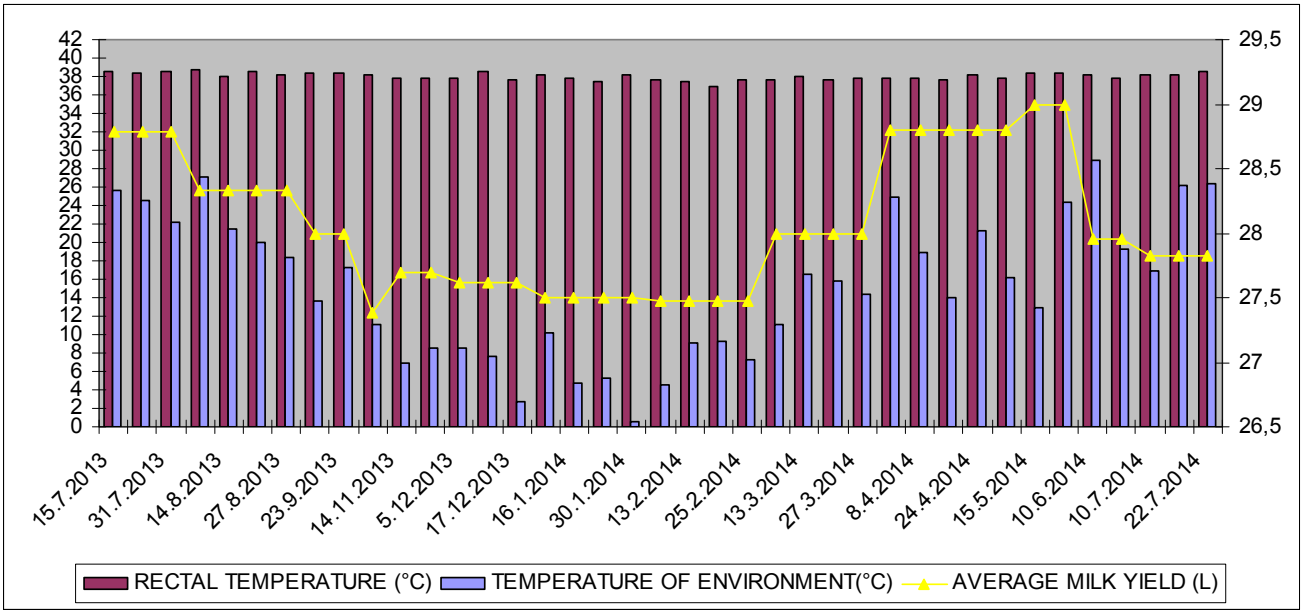
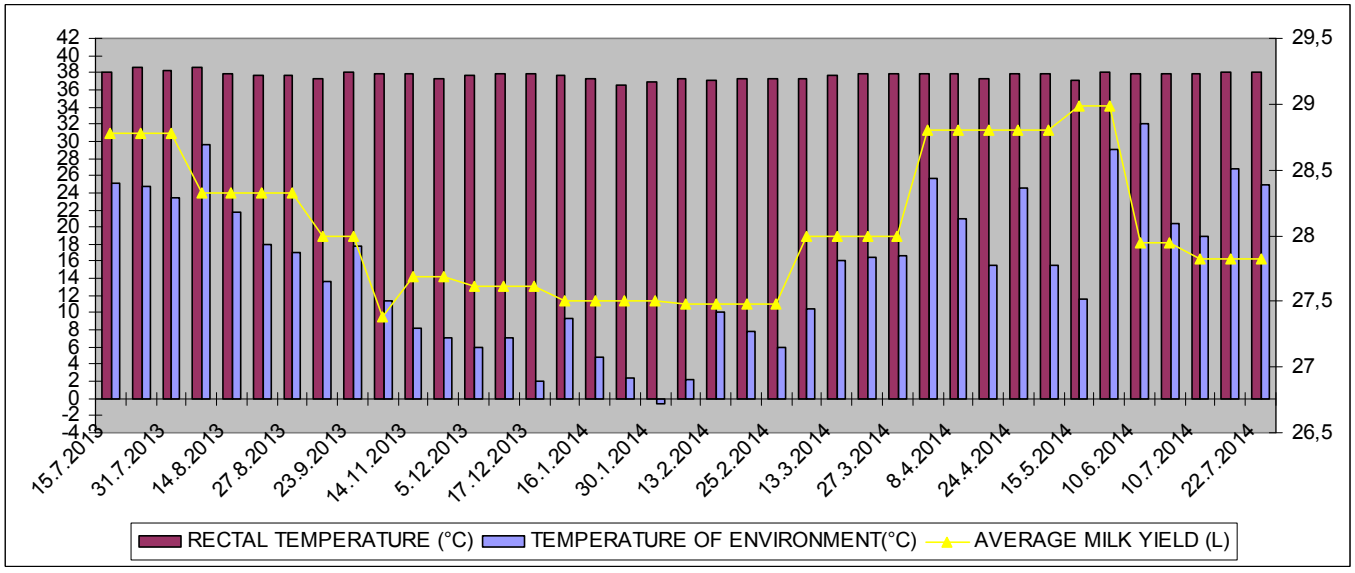


Fig. 2 Effect of temperature on the average performance at second group of dairy cows and heifers



This group of cows and heifers was in the barn, which took place only ventilation through open doors and windows. In contrast to the stables, where was the first group of dairy cows and heifers and where ventilation was used by fans and open doors. Significant fluctuations in ambient temperatures

were recorded during the spring and autumn. As claimed by [22] from the point of view of barn ventilation management, spring and autumn are difficult periods of the year because of frequent changes in air temperature, relative humidity and air velocity. A specific finding is that in an environment of high temperature fluctuates in cattle feed consumption and this decline is usually given in a context of declining milk production [2]. In the case of this experiment, it was found that the effect of high temperatures during the summer months, which ranged up to around 26.4 ° C, there was no significant decrease in the average yield of animals. In contrast, in this experiment were recorded the lowest values in the lowest ambient temperatures, i.e. in the winter months. In the case of low temperatures below thermoneutral zone increases in feed intake and water intake reduction, and usually will increase the consumption of dry matter per unit of production because part of metabolisable energy must be used to produce heat [23]. According to [24] negative effect of low temperature environment is not the result of direct cooling of animals, but is the result of disruption of feeding, watering, etc, i.e. disruption of the dynamic stereotype.

Conclusion

In selected groups of cows and heifers was measured rectal temperature and given in relation to the ambient temperature. It was examined how high the temperature effect on the body, what is their impact on heat stress and how it is influenced by the average yield of dairy cows and heifers. The average rectal temperature of the animals was between 37-38.5°C. The most significant fluctuations in rectal temperature were measured in a group of cows and heifers that are on the highest stage of lactation compared to the second group, it was in dairy cows and heifers immediately after calving. Group of cows and cows in 7 to 8 months after birth is also found in the stable with different microclimatic conditions, which could affect differences in measurement. These results indicate relatively large variability cows as regards their relationship to ambient temperature.

Regarding performance in this experiment, it was found that the effects of high temperatures during the summer months, which ranged up to around 26.4 ° C, there was no significant decrease in the average yield of animals. Contrary to expectations, the lowest performance will be recorded in the summer months, when the animals are most exposed to heat stress, were the lowest in the performance recorded in the period with the lowest ambient temperatures, i.e. in the winter months.

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