
EFFECT OF TEMPERATURE AND LIGHT INTENSITY ON THE PREFERENCE OF CUBICLES IN THE STABLE OF DAIRY COWS CZECH FLECKVIEH

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ABSTRACT

In this work we dealt with influence of environmental temperature and light intensity on preferred cubicle in the stable with Czech Fleckvieh. The observing took place in the GenAgro Říčany, a.s. Outer row of cubicles was observed, where 8 cubicles were with 85% shading, 8 cubicles were overshadowed to 95% and 8 cubicles were without shading. The temperature of environment and light intensity with every shading were measured at periodic intervals. 288 individual observing were done, where the occupancy of cubicles was evaluated. Cubicles with 85% shading were used by dairy cows 56 times (it's 58.33%), 95% overshadowed cubicles were occupied 83 times (it's 86.46%) and cubicles without shading were occupied 65 times (it's 67.71%). The difference in occupancy between cubicles 85 % overshadowed and 95% overshadowed was statistically confirmed. Statistically significant difference at occupancy of overshadowed and unshaded cubicles wasn't determined. The temperature in cubicles with 85% shading was 22.3°C and the light intensity was 2,825 lx, cubicles with 95% shading had the average temperature of 22.5 °C and the intensity of the light 1,977 lx and in cubicles without shading the average environmental temperature of 22.5 °C and the light intensity 57,039 lx were measured. As regard the temperature of the environment, there wasn't statistically significant difference between different shading. Different light intensity with different shading was statistically highly significant in all cases. It's evident from results, that the dairy cows preferred cubicles with 95% shading and cubicles without shading.

Key words: preferential behavior, Czech Fleckvieh, light intensity

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INTRODUCTION

It's important to realize, that summer weather significantly affects the behaviour and physiological processes in cattle. The increased thermal load of individual, caused by factors of the environment, such as temperature of the environment, relative humidity, speed of wind and light intensity, cause behavioural and physiological reactions. It can manifest by increasing of body temperature and breathing frequency (Hahn, 1999 , Ominski et al. , 2002 , West, 2003 and Tapki and Şahin, 2006). Warm and wet weather can negatively affect the productivity of cattle and then lower its prolificacy (Roman-Ponce et al., 1977 and De Rensis a Scaramuzzi, 2003). In some cases extreme temperatures and high light intensity can endanger health of animals, which can lead to death (Armstrong, 1994).

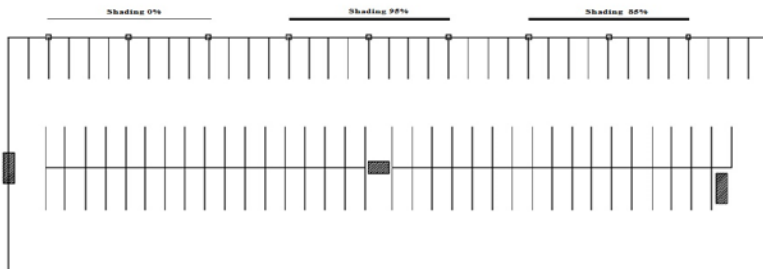
This negative effect of light intensity and environmental temperature can be lowered by creating of shading, which is sought after by cows on pastures (Kendall et al., 2006 and Tucker et al., 2008). Nevertheless it is unknown, which physiological aspects are important for cows when they are in shade. The type of shading affects microclimate created under it. Many of agricultural and forest engineers rated physical properties of different shading environment. They used artificially created shading as well as they examined chosen microclimatic indicators of naturally created shadow. However these predominantly comparative studies didn't fully evaluate microclimate, which arises after shading of some space, and usually they didn't focus on suitability of shading of stable part.

From experience we can say, that the environment in stables often doesn't match needs of animals. This lead to state, when their psychical well-being is not ensured and also their health can be negatively affected.

MATERIAL AND METHODS

The observing took place in the GenAgro Říčany, a.s. As the subject of observing was chosen one section in stable, in which we focused on outer row of cubicles, which were overshadowed from outer side of stable by two shading nets with 85% and 95% shading. In stable then formed three sections, one contained 8 cubicles with 85% shading, the second contained 8 cubicles with 95% shading and the last one contains 8 cubicles without shading (as you can see in scheme). In every section the environmental temperature (°C) and light intensity (lx) were measured in regular weekly intervals. This observing took part in three months, when 288 individual observing of dairy cows were done, in which occupancy of cubicles was evaluated. Gain values were evaluated and tested using Chi - square test.

Picture 1 Schema reference section and its shadow



RESULT AND DISCUSSION

Individual use of cubicles by preference can be seen in table Tab. 1. It's evident from results, that dairy cows had available overall for the time of observation 288 cubicles. Therefore they could use 96x cubicles, which were 85% overshadowed, 96x cubicles with 95% shading and 96x cubicles without shading. For the entire observing they used cubicles 204x. Cows used 56x (58,33%) cubicles with 85% shading, in which the average temperature of 22,3 °C and the intensity of the light 2825 lx. 83X (86,46%) they gave priority to cubicles with 95% shading, in which the average temperature of 22,5 °C and the intensity of the light 1977 lx. The cubicles without shading they preferred 65x (67,71%). In the latter the average light intensity of 57039 lx and the environmental temperature of 22,5°C were measured.

Statistically significant difference in preference of cubicles due to shading was determined between 85% and 95% shading. Further there was statistically highly significant difference in light intensity due to shading.

Tab. 1 Effect of light intensity and environmental temperature on the frequency of occupation cubicles

Shading (%)	Cubicles total	Occupancy (ks)	Occupancy (%)	Light intensity (lux)	Temperature (°C)
85	96	56 ^a	58,33 ^a	2825 ^A	22.3
95	96	83 ^b	86.46 ^b	1977 ^B	22.5
0	96	65	67.71	57039 ^C	22.5
Σ	288	204	70.83	-	-
Statistically significant	*	*	**	NS	

Could be possibly submitted, that dairy cows when choosing a place for resting prefer those cubicles, in which is minimal throughput of solar light. Similar results states also Tucker et al. (2008), in whose study the cows spend most of time in 99% shading. This also confirm in their work Bennett et al. (1985), who were finding out different preference of Shorthorn cattle, which preferred mostly the area with 80% shading. Most of time spending resting in area with 99% shading confirm also Kendall et al. (2006) and Schütz et al. (2008). Another research was finding out different types of shading according to weather conditions especially in extreme climate conditions, where the average temperature of the environment fluctuated. Dairy cows increasingly attended shadow at temperatures over 25°C (Fisher et al., 2002). Cattle is looking for shadow at higher thermal load, when it reflects on behaviour of cows by lowering of activity and lying in the shadow (Overton et al., 2002; Zahner et al., 2004 and Tucker et al., 2008). In our study the influence of temperature wasn't proved, because during the observed time there weren't any greater temperature fluctuations and the temperature itself wasn't lowered to a greater extent behind the shading.

Also can be observed some tendency to preferring of cubicles without any shading a this probably because without shading net there is better air exchange and this lead to better cooling of body. Similar results states also Schütz et al. (2008), who publish, that in unshadowed area wasn't possible to prevent airflow and thus also there occurred cooling of dairy cows. Vice versa in overshadowed areas occurred lower cooling of animals at mild weather conditions than in unshadowed areas. Therefore there was worse thermoregulation of organism possible in overshadowed areas.

The environmental temperature due to shading wasn't more or less different in our research, but Hrouz (2007) found out, that dairy cows for lying choose, if it's possible, open place, protected from wind and draft. At warm weather they prefer shadowed places in stable. Zejdová et al. (2011)

demonstrated, that dairy cows, when choosing resting place, follow many criteria, such as temperature and humidity of stable air, airflow, etc. And they always choose combination, which guarantees them comfort. Exposure to summer heat affects behaviour and physiology of cattle. Increased thermal load, caused by factors of environment, cause behavioural and physiological reactions, including increasing of body temperature and breath frequency and lowering of activity and food intake (Hahn, 1999, Ominski et al., 2002, West, 2003 and Ttapki, Sahin , 2006). Warm and wet weather can negatively affect breeding of dairy cattle by lowering of prolificacy (De Remis and Scaramuzzi, 2003). Excessive temperatures can in extreme cases seriously jeopardize good living conditions of animals and can lead even to death (Armstrong, 1994).

CONCLUSIONS

In conclusion we can say, that dairy cows in our research, when choosing a place for resting, prefer the cubicles with the highest shading, probably because of better possibility to cool than in overshadowed cubicles with higher throughput of light, which was also statistically significant. We can also see some tendency to preference of cubicles without shading. We suppose, that this fact was caused by higher airflow than in overshadowed cubicles and mainly in those days, when the intensity of airflow wasn't high and therefore there could be better cooling of dairy cows than in places partially closed.

It is obvious from results that dairy cows sought for resting cubicles with shading. We can therefore recommend into practice to install some covering in stables, preventing high light intensity in summer time.

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