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The Effect of Artificial Lighting of Cowsheds on the Milk Productivity of Cows Under the Conditions of Tethered Housing

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Abstract. The relevance of this study is conditioned upon the need to establish the possibility of using artificial lighting to increase the productivity of cows with tethered maintenance. This paper is aimed at identifying the effect of adjustable lighting of the feed table with LED lamps on the dairy productivity of cows. The cowshed lighting was provided by the SmartAC (LRC) automatic control system. The research method was to analyse the dynamics of cow milk yield under controlled photoperiod conditions and the level of illumination of the room. Two groups of cows were formed: experimental cows were kept in an experimental cowshed with natural illumination of the feed table of 101±20.2 lx and artificial illumination of 202±19.9 lx, the control group was kept in a typical 2-row room for 100 heads, in which natural illumination feed table was 139±22.8 lx, artificial – 26±3.2 lx. The duration of the photoperiod was 16 hours, and the ratio between natural and artificial lighting depended on the astronomical length of the day. Milk productivity of cows was assessed according to the method of control milking. Milk yields were recorded one month before the installation of the experimental lighting system (in February) and for the next four months (from March to June). Before the installation of the experimental lighting system, the difference in milk yield of cows was not statistically significant. In the future, despite fluctuations in the amount of milk yield caused by feeding, the experimental group of cows exceeded the control group in terms of milk productivity. The advantage of the cows of the experimental group in terms of daily milk yield was from 2.3 kg in March to 5.8 kg ($p<0.01$) in May. During the period of maximum daylight hours (June), the effect of artificial lighting on the dairy productivity of cows was insignificant. It was noted that the increase in the preference of experimental cows for milk yield occurs over several months, and the positive impact of improved lighting of the feed bunk increases along with an increase in milk productivity on the farm. That is, the higher the feeding level, the greater the effect of lighting control. The obtained results were confirmed after the analysis of the productivity of analogue cows by age and lactation phase, selected from the experimental and control groups. The results of the study are of practical value for the improvement of lighting in cowsheds with tethered housing

Keywords: dairy cattle, milk yield, illumination, photoperiod, feed bunk

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Introduction

Modern technological solutions for keeping cows usually provide that the animals are indoors most of the day, or 24 hours a day. The natural illumination of cowsheds is substantially less than the external one and is associated with the duration of daylight hours. To increase the productivity of cows on farms, various levels and duration of artificial lighting of cowsheds are used. These techniques are of great interest because, due to the influence on physiological processes and active behaviour of cows, they can improve their productivity. On average, about 17% of the total electricity consumption on dairy farms is used for lighting [1], and its optimisation allows influencing the productivity of cows and reducing the consumption of energy resources. There are several factors related to lighting, namely the types of lamps and their power, their location in the room, ceiling height, duration of the lighting period, etc. The study of variable parameters of dairy farm lighting systems and their impact on animal productivity allow developing optimal modes for practical application and justifying their feasibility.

Lighting of the farm premises is provided both by natural light and using various models of lamps. Depending on the choice of arranging natural lighting, there are substantial changes in the illumination of premises during the day and depending on the season. Thus, in milking parlours with a transparent roof, the illumination varied from 80 lx at night in winter to 1,030 lx at midday in summer [2]. The influence of lighting on the productivity of cows has many physiological prerequisites associated with humoral factors and the extension of the animal's activity period. An increase in milk production and a more stable lactation were observed in cows that calved before spring [3], when the natural lengthening of the photoperiod and the increase in illumination occur. Extending the duration of lighting up to 17 hours, compared to the natural 10...13 hours, and added lighting with 350 lx fluorescent lamps at eye level contributed to obtaining an added amount of milk [4]. There are several explanations for such phenomena. It was found [5] that light inhibits the production of N-acetyl transferase, which is the main enzyme during melatonin synthesis. Melatonin slows down the metabolism, activates the deposition of fat in the body and reduces the productivity of animals. The activity of melatonin production increases during the dark hours of the day and during sleep. Mammalian photoreceptors, which regulate melatonin synthesis, are thought to respond most to the blue spectrum of light. It was proved the possibility of added stimulation of dry cows with blue light through one eye on suppressing the level of melatonin in the blood and further increasing milk productivity in the first 12 weeks of lactation [6]. Suppression of the melatonin level due to the short-term use of the blue spectrum in LED lamps was also confirmed in calves [7], although it did not contribute to an increase in the level of hay consumption and the duration of chewing.

Light also affects changes in the concentration of glucocorticoids in the blood [8]. Cows that were kept under artificially extended lighting conditions (16 hours of light and 8 hours of dark period) were found to have 1.5...1.8 times higher prolactin levels than cows that were kept in natural light conditions lasting 9...12 hours [9]. The extension of the duration of the light period during the day was associated with the increased secretion of insulin-like growth factor by dairy cows [10], which in turn leads to an increase in milk productivity [11]. It was also established that the levels of prolactin and insulin-like growth factor were the highest in Holstein cows in rooms with 200 lx illumination, compared to other groups [12].

In studies on determining the optimal lighting and duration of lighting in rooms with automatic milking systems [13], it was found that the highest milk productivity (40.8 kg and 39.9 kg) is observed under lighting conditions of 16 hours per day at the level of 50 lx and 100 lx. Increasing the illumination to 200 lx and using only natural light for 14.2 hours a day led to a decrease in milk yield. In this experiment, it was established that the content of dry milk residue was higher in the milk of cows that were kept in rooms with natural lighting. According to the literature review [14], increased light brightness has a positive effect on reducing the service period of cows, but not all researchers obtained unequivocal results. They note that increasing the illumination to 200 lx can be a stress factor.

An understudied factor in animal husbandry is the spectrum of light that will be optimal for application. It is known that the leaves of plants absorb visible radiation in the red, blue, and infrared spectra. It is believed that cows can partially perceive short-wave infrared radiation when choosing feed. Studies [15] show that the eye of cattle responds to a spectrum of light close to infrared radiation, and combined illumination of different spectra contributes to more active behaviour of animals. Studies confirm the effect of light spectra on physiological responses in cows [16]. But the absence of a substantial difference in milk productivity indicates that the spectral composition of LED lighting in the cowshed is secondary to photoperiod duration and lighting intensity.

In farm settings, it is important to understand whether the lighting period needs to be synchronised with the time of day. It was found [17] that the lighting time using LED lamps has only a certain effect on the parameters of cow blood and its immune response, but the difference in prolactin, IgA and IgG content was not significant, and there were no changes in milk production.

Automation of the lighting mode of cowsheds with the help of programmable logic controllers is a modern trend. A study was conducted on the effect of the developed LED lamp on the health and productivity of black-and-white cows [18]. It was established that the use of systems with an adjustable amount of light does not adversely affect the body of cows, but on the contrary, stimulates their activity and promotes more active feed consumption and increased milk production.

In general, studies confirm the positive influence of certain ranges of illumination and optimising the duration of the photoperiod on the productivity of cows, but many issues are still understudied. It is relevant for Ukraine to investigate the possibilities of adjustable lighting systems in cowsheds with both tethered and untethered housing since such premises still are widespread and the technological conditions for the use of cows in them require improvement.

The purpose of this study was to analyse the influence of the light level of the insulin-like growth factor on the productivity of dairy cows under tethered conditions.

Materials and Methods

Research was carried out during February-June 2021 in the conditions of a separate unit of the National University of Life and Environmental Sciences of Ukraine "Agronomic Research Station" in two-row cowsheds with tethered housing. For studies of the efficiency of the experimental lighting system, a two-row cow shed with tethered housing was allocated (Fig. 1). The width of the room was 10.3 m, the length of a solid row of stalls was 30 m. Feed table with a width of 3.5 m. The windows were located in a longitudinal wall on one side, the opposite wall was solid. The initial lighting system provided for the use of 16 LED lamps with 10 W lamps. The lamps were arranged 8 in one row above the stalls at a height of 2.55 m with an interval of 3 m. At the beginning of March 2021, LED lamps with the SmartAC automatic control system (LRC) were installed in the experimental barn. Lamps of the experimental lighting system with a power of 60 W with LEDs of different spectra were placed above the side of the feed table on the side of the experimental group of cows. Total number of luminaires – 6 pcs. Lighting control was automatic with maintenance of a duration of 16 hours a day and considering the length of daylight and with the possibility of manual control.

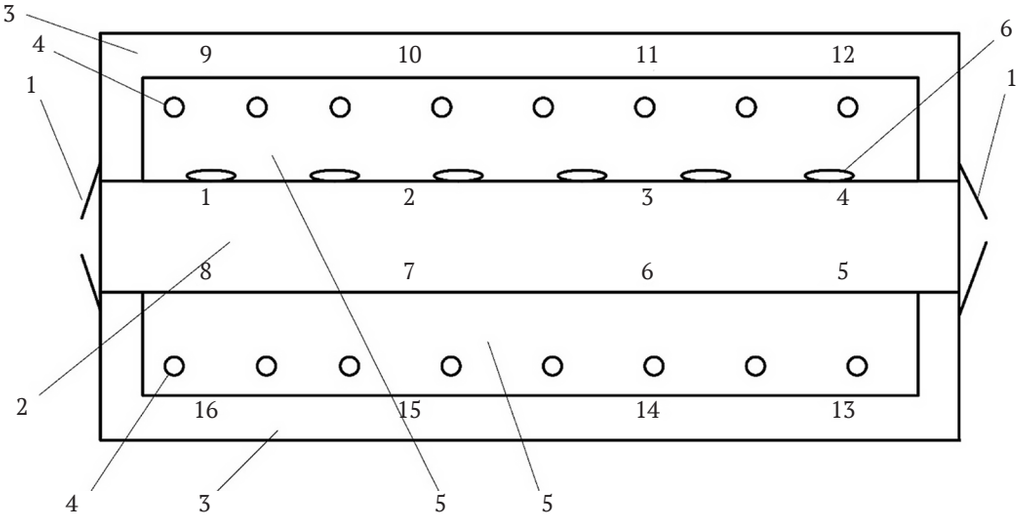

Figure 1. Scheme of an experimental cowshed 1 – gate; 2 – feed bunk; 3 – technological passage; 4 – LED lamps with 10 W lamps; 5 – stall location area; 6 – LED lamps of the experimental lighting system with a power of 60 W. 1…16 – places of measurement of illumination in the cowshed

The experimental group of cows (24 cows) was kept in a continuous row on one side of the experimental cowshed.

For control, another group of cows (52 heads) was taken, which were kept in a typical 2-row cowshed for 100 heads with tethered confinement. The artificial lighting system was the same as in the experimental cowshed before the installation of the experimental installation.

The effect of changing the lighting system on the productivity of cows was determined by comparing the average productivity per milking cow in the experimental and control groups. To clarify the obtained results, analogue cows were selected from the experimental and control groups, whose performance was compared during the experimental period. The first calving cows (6 heads in the experimental group and 8 heads in the control group) were selected for the analogue groups, which were at the end of the second–beginning of the third phase of lactation at the time of installation of the experimental lighting system. This period was chosen to exclude the possibility of a physiologically determined increase in milk yield at the beginning of lactation, so all changes in milk productivity in cows are mainly due to the influence of the feeding factor and technological conditions of keeping.

The duration of the photoperiod in the cowsheds was 16 hours per day, during which the level of illumination depended on the length of the daylight hours and the artificial lighting system. Illumination in the premises was determined by a WALCOM lx-1330B lux meter, by the method of point measurements (16 points) along the feed bunk and the technological passage behind the stalls at floor level and at a height of 1 m.

Cows were fed with a general mixed diet using silage, hay and a mixture of concentrated fodder. The composition of the ration during the study period partially changed, but the level of feeding of the cows of the experimental and control groups did not differ among themselves. In the summer, part of the silage was replaced with freshly mown alfalfa. Cows of the experimental and control groups were milked in the milk duct. Individual milk productivity was determined by the method of monthly control milkings. The materials were processed using the methods of variational statistics. Means M, statistical error ±m, probability of difference of means $p \leq 0.05$; 0.01; 0.001 were determined.

Results and Discussion

Before the installation of the experimental lighting system in the experimental barn, the artificial lighting above the feed bunk was extremely weak (Table 1). The main reasons for this are the low power of the lamps and their location. The arrangement of lamps above the stalls allowed illuminating the working area of machine milking operators, but the feeding area was almost unlit. During the day, the natural illumination of the experimental barn was about

101 lux, which is considered a sufficient level [14] to ensure high productivity. In the stable period, the time of such illumination of the feeding zone is limited by the length of the day (at the beginning of the experiment it was 11 hours and 5 minutes), which should have an effect on the activity of forage eating and the physiological functions of the cows' body.

Table 1. *Illumination of cowsheds at the floor level of the feed bunk*

Indicator	Illumination, lx
Experimental cowshed	
Basic artificial lighting before installing the experimental system	5±0.8
Artificial lighting after installation of the experimental system	202±19.9
Natural lighting*	101±20.2
Control cowshed	
Artificial lighting	26±3.2
Natural lighting*	139±22.8

Note: * *Natural lighting was determined 1 hour after sunrise*

In the control barn, the artificial lighting of the feed table was 21 lx higher than in the experimental one, but it was substantially inferior to the parameters recommended in the literature and current standards [19]. The average level of natural light in it was also higher by 38 lx, but the difference between the rooms was within the statistical margin of error.

Arrangement of an experimental system with higher-power lamps above the feed table in the experimental cowshed allowed increasing its illumination by 40 times and bring it to the level of 200 lx, which is described in modern scientific experiments [13; 17]. Thus, the experimental group of cows was kept under conditions when the illumination of the feed table was at least 100 lx for 16 hours. In the experimental group, the duration of daylight hours with this level of illumination depended on astronomical factors and varied from 11 to 16 hours.

The average number of cows in the experimental and control groups changed during the experiment (Fig. 2). In February, a month before the installation of the experimental lighting system, the difference in milk yield in the groups was not statistically significant and amounted to 0.9 kg.

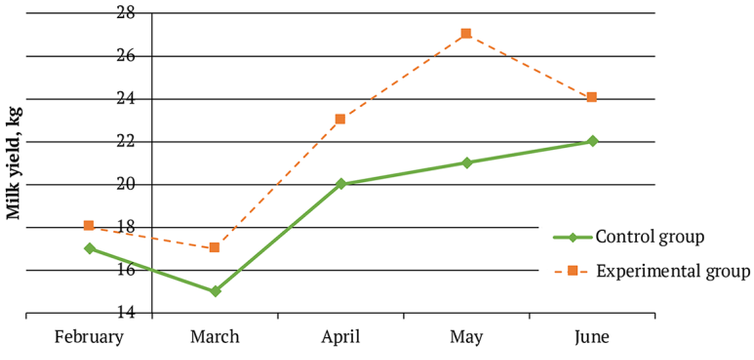

Figure 3. Average daily yield per dairy cow in experimental and control barns

During March, the weight in both groups decreased by an average of 2.2 kg, which is conditioned upon a change in the composition of the rations (the amount of protein feed additives was reduced, and silage feed was changed). But in the experimental cowshed, where the experimental lighting system was already working, the milk productivity of the cows was 2.3 kg higher. From April, there was a gradual increase in milk yield in both groups of cows, but the difference between them in terms of milk productivity also increased. Thus, in April, the weight of the cows of the experimental group was greater by 3.1 kg ($p<0.05$), in May by 5.8 ($p<0.01$). In June, when the duration of the astronomical daylight reached a maximum (16 h 27 min), and the cows were kept mainly in the walking areas, the difference in milk yield in the groups decreased to 1.8 kg and became statistically insignificant. In relative values, the advantage of the cows of the experimental group over the control group in terms of milk productivity ranged from 16% in March and April to 27% in May. Thus, it can be argued that increasing the artificial lighting of the feed table to 100...200 lx for 16 hours per day allows increasing the efficiency of the cows' use of the distributed fodder and improving their milk productivity. At the same time, the control and experimental groups were formed from cows of different ages and at various stages of lactation, and therefore the conclusion made required verification.

For verification, data on the performance of first calving cows were selected from both groups, which at the beginning of March were at the end of the second – the beginning of the third phase of lactation (Table 2).

***Table 2**. Illumination of cowsheds at the floor level of the feed bunk*

Month	Experimental cowshed (n=6)	Control cowshed (n=8)
February	18.1±1.1	18.4±1.0
March	16.4±1.0	15.0±1.0
April	23.3±1.5*	18.3±1.6
May	28.6±4.3	22.4±2.0
June	23.4±1.2	20.2±3.1

***Note:** * p<0.05*

The overall performance dynamics of the selected analogue cows was similar to the changes found in the full groups. In February, before the start of the experiment, the cows had almost the same productivity, in March the milk yield decreased, but there was a statistically insignificant advantage of the experimental cows of 1.4 kg. In the future, until May inclusive, milk yields began to grow, which reflects positive changes in feeding. In the experimental animals, the increase in milk yield was more substantial. In April, their advantage over the control group was 5.0 kg ($p<0.05$), and in May – 6.2 kg. In June, milk yield in both groups decreased, which is a combined result of feeding and elevated temperatures that are not favourable for cows, and the difference between them decreased by almost 2 times, due to the disappearance of the influence of the artificial lighting factor in the conditions of the maximum duration of the daylight hours, which exceeded 16 hours.

Therefore, during tethered keeping, the illumination of the feed table at the level of 100…200 lx with a duration close to the maximum duration of daylight (16 hours) allows increasing the milk productivity of cows, and the effectiveness of this method will increase against the background of a higher level of milk productivity of cows.

Analysing the obtained results, three main patterns can be identified. The first is to increase the milk productivity of cows in conditions of increasing the level of light in the cowshed. In similar studies [13], this result is confirmed. The authors indicate that under the conditions of only natural lighting per day, at the level of 10 lx, the milk yield of cows substantially decreases, but the amount of dry milk residue in it increases. And comparing the effectiveness of various levels of illumination with the use of artificial lighting (50, 100, and 200 lx), 100 lx was determined to be optimal. In this group of cows, the yield of milk was obtained, which was not significantly different from the highest in the experimental groups, but they exceeded the others in terms of the total yield of dry milk residue. The milk of these cows also had the lowest levels of cortisol, indicating a reduction in the stress load on the animals. Other authors make similar conclusions regarding the optimal levels of lighting in the cowshed and the increase in the stress load on cows at lighting levels of more than 200 lx [14]. In the conducted study, the level of natural lighting in cowsheds was close to the recommended level [13]. But the duration of time with this level of illumination depended on the daylight hours, and during the study increased approximately from 11 to 16 hours per day. At the end of the study, the control cows were kept for 16 hours with a light level that is close to best, which explains the disappearance of the probable difference in daily milk yield with the experimental group. Notably, the natural lighting outside the premises during the day considerably exceeds 1,000 lux, and therefore it is advisable to further check the possibility of an adverse effect of a long stay of dairy cows under bright sunlight.

The second regularity, which was established in the study, is the postponement of the positive effect of improved cowshed lighting on the dairy productivity of cows. The highest effect was noticed three months after the beginning of the experiment, in May, although during this period the illumination of the cowshed with the control group over 100 lx lasted from 15 to 16 hours, which is an indicator close to the experimental group. A similar result with a delay in productivity growth was obtained in Great Britain [20]. The authors note that illumination of 150 lx for 16-18 hours per day at cow eye level increased milk yield by approximately 2 litres per day, with a delay of 2-3 weeks. In this study, it was noted that feed intake also increased, but with a delay of 7-9 weeks. Therefore, it can be assumed that milk yield increases in the short term due to humoral effects caused by the influence of lighting on the concentration of melatonin, prolactin, and insulin-like growth factor [5; 10; 12]. Overall, the productivity of cows increases due to higher feed consumption. In June, when the duration of the photoperiod with natural lighting reaches its maximum and the conditions in the experimental and control cowsheds are equalised, the preservation of the advantage in terms of milk yield from cows that were kept until this time in improved lighting conditions is also explained by the delay in the reaction of the animals.

The third pattern observed in the study is that the positive effect of light exposure on milk production of cows increases in conditions of increased productivity. During the study, there were changes in many factors that have a direct impact on the productivity of cows, namely the composition of the diet and temperature regimes caused by changes in the seasons. It was found that with the increase in average productivity, the difference between the control and experimental groups also increases. Similar features are not covered in the scientific literature, so this problem can be further studied in more detail.

Conclusions

The lighting of the feed bunk affects the productivity of cows in tethered housing. Extending the duration of the photoperiod to 16 hours per day with illumination of 100…200 lx allowed the experimental group to increase milk yield by 16…27% compared to the control group,

which was confirmed by the analysis of the productivity of analogue cows.

In periods with the maximum duration of the daylight hours and a sufficient level of natural lighting, the influence of artificial lighting on the productivity of cows is minimal. An increase in the milk productivity of cows due to the improvement of lighting of the feed bunk occurs gradually over the following months. The degree of influence of lighting on the productivity of cows depends on feeding, the higher the level of nutrition, the greater the effect of optimising the lighting of premises.

Since a change in the degree of influence of artificial lighting on the productivity of cows was observed throughout the year, in further studies it is advisable to investigate the effectiveness of calendar schedules of switching on and off lamps and to determine the level of compensation of illumination during the periods of sunrise and sunset.

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References

[1] Chavhan, B.B., Agrawal, A.K., Sahu, C., Chopde, S.S., & Kalla, A.M. (2018). Day lighting in dairy farms. In *Novel dairy processing technologies* (pp. 243-251). doi: 10.1201/9781315167121-11.

[2] Dimov, D., Penev, T., & Marinov, I. (2020). Illumination levels in milking parlor in dairy cows freestall housing system. *Bulgarian Journal of Agricultural Science*, 26(1), 78-82.

[3] Polishchuk T.V. (2019). Influence of calving period on the character of lactation curve in the cows of dairy breeds. *Agrarian Science and Food Technologies*, 3(106), 114-127.

[4] Gavan, C., & Motorga, V. (2009). The effect of supplemental light on milk production in holstein dairy cows. *Scientific Papers Animal Science and Biotechnologies*, 42(2), 261-265.

[5] Illnerova, H., & Sumova, A. (1997). Photic entrainment of the mammalian rhythm in melatonin production. *Journal of Biological Rhythms*, 12(6), 547-555. doi: 10.1177/074873049701200609.

[6] Murphy, B.A., Herlihy, M.M., Nolan, M.B., O'Brien, C., Furlong, J.G., & Butler, S.T. (2021). Identification of the blue light intensity administered to one eye required to suppress bovine plasma melatonin and investigation into effects on milk production in grazing dairy cows. *Journal of Dairy Science*, 104(11), 12127-12138. doi: 10.3168/jds.2021-20526.

[7] Elsabagh, M., Mon, M., Takao, Y., Shinoda, A., Watanabe, T., Kushibiki, S., Obitsu, T. & Sugino, T. (2020). Exposure to blue LED light before the onset of darkness under a long-day photoperiod alters melatonin secretion, feeding behaviour and growth in female dairy calves. *Animal Science Journal*, 91(1), e13353. doi: 10.1111/asj.13353.

[8] Phillips, C.J.C., & Schofield, S.A. (1989). The effect of supplementary light on the production and behaviour of dairy cows. *Animal Science*, 48(2), 293-303. doi: 10.1017/S0003356100040290.

[9] Peters, R.R., Chapin, L.T., Emery, R.S., & Tucker, H.A. (1981). Milk yield, feed intake, prolactin, growth hormone and glucocorticoid response of cows to supplemented light. *Journal of Dairy Science*, 64(8), 1671-1678. doi: 10.3168/jds.S0022-0302(81)82745-2.

[10] Dahl, G.E., Elsasser, T.H., Capuco, A.V., Erdman, R.A., & Peters, R.R. (1997). Effects of a long daily photoperiod on milk yield and circulating concentrations of insulin-likegrowth factor-I. *Journal of Dairy Science*, 80(11), 2784-2789. doi: 10.3168/jds.S0022-0302(97)76241-6.

[11] Dahl, G.E. (2003). Photoperiod management of dairy cattle for performance and health. *Advances in Dairy Technology*, 15, 347-353.

[12] Park, J.R., Belal, S.A., Na, C.S., & Shim, K.S. (2019). Effect of LED lighting intensity on productivity, blood parameters and immune responses in dairy cows. *Korean Journal of Organic Agriculture*, 27(2), 161-171.

[13] Lim, D.H., Kim, T.I., Park, S.M., Ki, K.S., & Kim, Y. (2021). Effects of photoperiod and light intensity on milk production and milk composition of dairy cows in automatic milking system. *Journal of Animal Science and Technology*, 63(3), 626. doi: 10.5187/jast.2021.e59.

[14] Penev, T., Radev, V., Slavov, T., Kirov, V., Dimov, D., Atanassov, A., & Marinov, I. (2014). Effect of lighting on the growth, development, behaviour, production and reproduction traits in dairy cows. *International Journal of Current Microbiology and Applied Sciences*, 3(11), 798-810.

[15] Olin, N.L., Efremova, E.N., Niyazov, A.M., & Lekomtsev, P.L. (2021). The impact of the optical radiation spectrum of artificial lighting on the milk producing ability of cows. *BIO Web of Conferences*, 36, aricle number 05016. doi: 10.1051/bioconf/20213605016.

[16] Lindkvist, S., Ternman, E., Ferneborg, S., Bankestad, D., Lindqvist, J., Ekesten, B., & Agenas, S. (2021). Effects of achromatic and chromatic lights on pupillary response, endocrinology, activity, and milk production in dairy cows. *Plos One*, 16(7), article number e0253776. doi: 10.1371/journal.pone.0253776.

[17] Park, J.R., Yoon, N.J., Belal, S.A., & Shim, K.S. (2018). Effect of led lighting time on productivity, blood parameters and immune responses of dairy cows. *Korean Journal of Organic Agriculture*, 26(3), 515-532.

[18] Loshkarev, I.Y., Shirobokova, T.A., & Shuvalova, L.A. (2019). Automation of artificial lighting design for dairy herd cows. *Journal of Physics: Conference Series*, 1333(4), article number 042018. doi: 10.1088/1742-6596/1333/4/042018.

[19] VNTP-APC-01.05 "Livestock enterprises". (2005). Kyiv: Ministry of Agrarian Policy of Ukraine.

[20] Chamberlain, A.T. (2018). The use of supplementary lighting in dairy cow housing to increase milk production. *Livestock*, 23(3), 130-138. doi: 10.12968/live.2018.23.3.130.

Вплив штучного освітлення корівників на молочну продуктивність корів за умов прив'язного утримання

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Анотація. Актуальність дослідження зумовлена потребою встановити можливість використання штучного освітлення для підвищення продуктивності корів за прив'язного утримання. Дана стаття спрямована на виявлення впливу регульованого освітлення кормового столу світлодіодними світильниками на молочну продуктивність корів. Освітлення корівника забезпечувалась автоматичною системою керування SmartAC (LRC). Методом дослідження був аналіз динаміки надоїв корів у умовах контрольованого фотоперіоду і рівня освітленості приміщення. Було сформовано дві групи корів: дослідних утримували в експериментальному корівнику з природною освітленістю кормового столу 101±20,2 Лк і штучною – 202±19,9 Лк, контрольну групу – утримували в типовому 2-рядному приміщенні на 100 головомісць, в якому природна освітленість кормового столу становила 139±22,8 Лк, штучна – 26±3,2 Лк. Тривалість фотоперіоду становила 16 годин, а співвідношення між природним і штучним освітленням залежало від астрономічної тривалості дня. Молочну продуктивність корів оцінювали методом контрольних доїнь. Надої фіксували за місяць до встановлення експериментальної системи освітлення (у лютому) та впродовж чотирьох наступних місяців (з березня по червень). До встановлення експериментальної системи освітлення відмінність за надоєм корів була статистично не значуща. У подальшому, попри коливання величини надоїв, які зумовлені годівлею, дослідна група корів переважала контрольну за рівнем молочної продуктивності. Перевага корів дослідної групи за добовим надоєм становила від 2,3 кг у березні до 5,8 кг ($p<0,01$) у травні. У період максимальної тривалості світлового дня (червень) вплив штучного освітлення на молочну продуктивність корів був незначний. Помічено, що нарощування переваги дослідних корів за надоєм відбувається впродовж кількох місяців, а позитивний вплив покращеного освітлення кормового столу збільшується разом із зростанням молочної продуктивності у господарстві. Тобто чим вищий рівень годівлі, тим більший ефект від управління освітленням. Отримані результати були підтверджені після аналізу продуктивності корів-аналогів за віком і фазою лактації, виділених із дослідної і контрольної груп. Результати дослідження становлять практичну цінність для удосконалення освітлення в корівниках з прив'язним утриманням

Ключові слова: молочна худоба, надій, освітленість, фотоперіод, кормовий стіл