

Indicators of the behavior of highly productive cows under the conditions of using feed stations

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Abstract

The purpose of this work was to study the influence of feed stations on behavioral indicators of high-yielding cows. The research was conducted at two farms of TDV "Terezine" (Kyiv region) with different options for feeding fodder: from a feed table and a feed table + at feed stations. On each farm, a group of unpregnant high-yielding cows of the Ukrainian black-spotted dairy breed (II lactation and older) with a daily productivity of 30 kg and above during the calving period (2–3 months of lactation) was formed. Using feed stations for concentrated feeds affected the daily behavior of high-yielding cows. With this option of feeding, lower values of the duration of walking and standing were observed (by 16.3 and 9.6 min), as well as a slightly longer duration of lying down rest – by 17.4 min. The total feeding duration was longer due to the consumption of concentrated feeds at feeding stations, which was 25.6 minutes. At both farms, the peak of daily foraging activity occurred at 08:00 and 18:00. On average, during the day, cows approached the feed table and ate feed 8.7 times (maximum 12, minimum 6). At the farm with concentrated fodder feeding at feed stations, the average hourly duration of fodder consumption from the feed table was slightly lower (by 1–8 min) than at the farm where cows were fed only with fodder mixtures. At the farm, with the use of feed stations, the values of the indices of comfort, use of stalls, and feeding were 3.14, 1.62, and 0.03 % higher compared to the option where cows were fed only with feed mixtures. This trend is explained by a slightly higher duration of rest and general feed consumption and, accordingly, a lower duration of walking and standing of animals. Somewhat lower values were for the index of standing, discomfort, and drunkenness, which were higher for feeding feed from the feed table – by 1.79, 0.04, and 0.008%, respectively.

Keywords: dairy cows; feeding; feed stations; feed table; behavior.

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1. Introduction

In recent years, powerful dairy farms equipped with the most modern technical means of the world's leading manufacturers have been built on the territory of Ukraine. First of all, this concerns the milking of cows and the primary processing of milk on farms, preparation for feeding, and distribution of fodder (Cordova et al., 2018; Ruban et al., 2020).

The application of such techniques and equipment in practice is connected not only with the reliable provision of low-cost and efficient execution of technological processes but also with the need to satisfy maximally the biological and physiological needs of animals (Borshch et al., 2020b; Piwczynski et al., 2020). No less important is the economic component of livestock production (Bach & Cabrera, 2017; Holloway & Bear, 2020).

The biological and physiological needs of animals are primarily related to feeding and rest. In highly productive cows, it is also necessary to give milk promptly during milking (Borshch et al., 2021). These needs are manifested in behavioral reactions. In dairy cattle, methods of keeping and herd hierarchy have a significant influence on them (Sitkowska et al., 2015). When we have loose cows housing, the importance of herd hierarchy increases and is primarily manifested in feeding animals (Borshch et al., 2020a).

The influence of feeding on the productivity of cows refers not only to the general level and balance of rations but also to the provision of individual needs of animals in energy and nutrients depending on productivity and physiological state (Miguel-Pacheco et al., 2014; Drach et al., 2017). When organizing feeding, one should also remember the peculiarities of cattle's feed reaction and its digestive system. It manifests that after taking feed in ruminants, there is

a period of chewing feed (Hansen, 2015). Depending on the composition of the diet, its duration is 1.4–1.6 times longer than eating fodder. Moreover, repeating these processes during the day is multiple (Ruban et al., 2022).

The purpose of this work was to study the influence of using feed stations on behavioral indicators of high-yielding cows.

2. Materials and methods

The research was carried out at two farms of the Terezine State Farm (Kyiv region). At the first farm, animals are kept without loose in easily assembled rooms with milking on the “Parallel” machine. In the second one, we have the loose keeping of animals in easy-to-assemble rooms with voluntary milking with a robotic unit. The animals on both farms are fed complete mixed rations. However, on a robotic farm, animals receive part of the concentrated feed individually (depending on productivity, stage of lactation, and physiological state) during milking and at feed stations.

In each of the farms, a group of nonpregnant high-yielding cows of the Ukrainian black-spotted dairy breed (II lactations and older) with daily productivity of 30 kg and more during the breeding period (2–3 months of lactation) was formed ($n = 32$).

The daily behavior of cows was studied for two consecutive days by visual observations. Every 10 minutes, the number of cows in the experimental groups was recorded during the observation, actively or passively consumed feed (from the feed table and at the feed stations), rested standing or lying near the feeder or on the litter, moved, drank water, chewed gum, etc.

The duration of behavioral reactions in cows was equated to the recommended daily values according to Cook's method (Cook, 2020). The duration of the leading behavior-

al reactions was equated to the “ideal day” schedule, according to which at least 50 % of the duration of the day, the animals should rest in a lying position, 20–21 % – consume feed, up to 12 % – walk and 3–4 % drink water (Krawczel & Grant, 2009). The comfort of the animal housing conditions was determined by the cow comfort index (the ratio of cows lying in the boxes to the cows in contact with the box), the cow standing index (the ratio of the cows standing in the boxes to the cows in contact with the box), the discomfort index (the number of cows, which stand with two forelimbs in the stall and hind legs in the manure channel to cows in contact with the stall) and the stall utilization index (the ratio of cows lying in the stalls to the rest of the cows, except those consuming feed) (Nelson, 1996; Overton et al., 2002; Cook et al., 2005; Tucker et al., 2005).

The data are expressed as means \pm standard error of the mean. To assess statistical significance, a Student's *t*-test was employed, with significance levels indicated as * $P \leq 0.05$, ** $P \leq 0.01$, and *** $P \leq 0.001$. The statistical analyses were conducted using STATISTICA software (Version 11.0, 2012).

3. Results and discussion

It has been established that using feed stations with concentrated feed influenced the daily behavior of highly productive cows (Table 1). With this type of feed feeding, lower values of the duration of walking and standing (by 16.3 and 9.6 min) were observed, which are indicators of animal comfort and have a direct impact on milk production. Also, with this type of feed feeding, a slightly longer duration of lying down rest was observed – 17.4 minutes. The total duration of feed consumption was higher due to the consumption of concentrated feed at feed stations, which was 25.6 min.

Table 1

Duration of acts of daily behavior of highly productive cows depending on the option of fodder feeding, min ($M \pm m$)

| An act of behavior | Option of fodder feeding: | |
|--------------------------|---------------------------|--|
| | from the feed table | from the feed table + at the feed stations |
| Lying | 746.3 \pm 8.33 | 763.7 \pm 11.23 |
| Eating of feed (general) | 256.3 \pm 2.17 | 275.1 \pm 2.54* |
| including | | |
| - from the feed table | 256.3 \pm 2.17 | 249.5 \pm 2.22 |
| - at the feed stations | - | 25.6 \pm 0.88 |
| Walking | 98.8 \pm 1.67 | 82.5 \pm 2.49* |
| Standing | 142.6 \pm 2.26 | 133.0 \pm 2.03 |
| Watering | 48.8 \pm 0.18 | 47.6 \pm 0.44** |

Note: * $P \leq 0.05$; ** $P \leq 0.01$ as compared with feeding from the feed table

Analyzing the daily feeding behavior of cows depending on the option of feeding fodder, it has been established that the peak of feeding activity occurred at 8:00 a.m. and 6:00 p.m. (Figure 1). On average, during the day, cows approached the feed table and ate feed 8.7 times (maximum

12, minimum 6). At the farm where feed stations were used for feeding with concentrated feed, the average hourly duration of feed consumption from a feed table was slightly lower (by 1–8 min) than in a farm where feed was fed exclusively from a feed table.

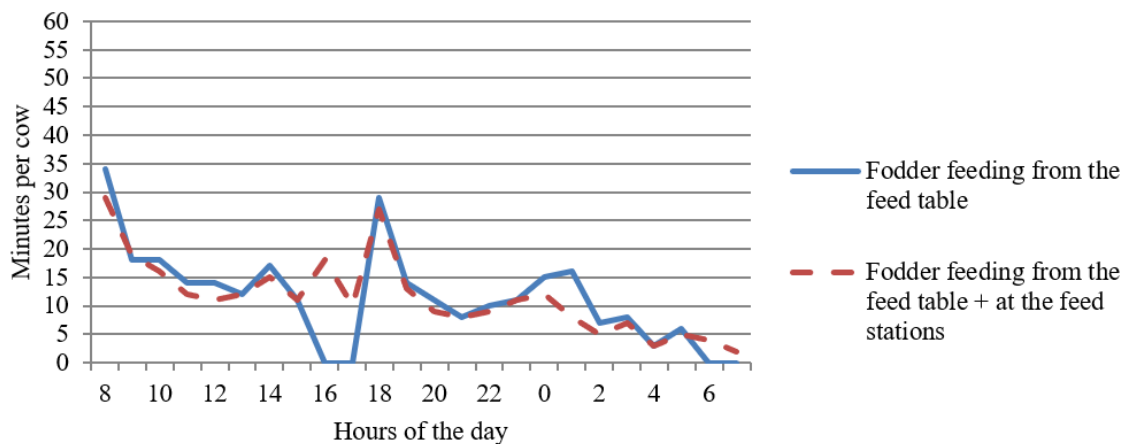


Fig. 1. Daily foraging activity of high-yielding cows depending on the forage feeding option

The influence of the option of fodder feeding can be evaluated by the values of indices that characterize both the welfare of animals and their adaptation characteristics (Table 2). It has been established that at the farm using feed stations, the values of three indices of animal behavior were better compared to the farm where feeding is carried out exclusively from a feed table, which indicates more com-

fortable conditions for the exploitation of cows. This trend is explained by a slightly higher duration of rest and general feed consumption and, accordingly, a lower duration of walking and standing of animals. At the same time, slightly lower values were for the index of standing, discomfort, and watering, which were higher for feed feeding from the feed table by 1.79, 0.04, and 0.008 %, respectively.

Table 2

Behavioral indices that characterize the comfort and well-being of cows depending on the forage feeding option, %

| Index of | Option of fodder feeding: | |
|-----------------|---------------------------|--|
| | from the feed table | from the feed table + at the feed stations |
| - comfort | 89.16 | 92.30 |
| - standing | 8.53 | 6.74 |
| - discomfort | 4.51 | 4.47 |
| - using a stall | 84.72 | 86.37 |
| - feeding | 0.36 | 0.39 |
| - watering | 0.058 | 0.050 |

4. Conclusions

It has been established that the use of feed stations for feeding high-yielding cows with concentrated feed had a positive effect on the duration of rest and total feed intake (+17.4 and 18.8 min), which are correlated with productivity. The values of the leading behavioral indices, which indicate the well-being of housing conditions (comfort, use of stalls, and feeding), at the farm using feed stations were 3.14; 1.62 and 0.03 % higher, compared to the option where feeding is carried out exclusively from the feed table.

Conflict of interest

The authors declare that there is no conflict of interest.

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