WATER CONSUMPTION IN LACTATING COWS HOUSED IN COMPOST-BEDDED PACK BARNS

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Keywords–. Farm; Indicator; Mathematical Model.

INTRODUCTION

The aims of the study were (i) evaluate the water consumption of lactating cows kept in compost-bedded pack barns in commercial farms; (ii) suggest values of the indicator liters of water per liters of milk; (iii) propose a mathematical model to predict the daily water consumption of lactating cows in CPB.

The target audience of this study is farmers, agroindustry, and extension services. It is expected that the water measurement presented in this study will be used to improve the water management in compost-bedded pack barns and highlight the main threats and weaknesses associated with intensive production systems.

MATERIAL AND METHODS

A total of four compost-bedded pack commercial dairy farms underwent comprehensive water monitoring from January 2021 to January 2025. The database comprises 140 records. The water measured was free water lactating cow's intake. It is defined as water that is consumed directly from a water device. The monitoring utilized continuous flow of analog water meters, specifically installed to measure drinking water consumption. The assessed consumption may include the water used to wash the drinkers, which is normally done daily on the monitored farms.

Monthly data were systematically recorded online, with farmers personally reading the water meter and inputting the data into the system. The information gathered encompassed water consumption per water meter, the average daily number of milking cows, and total milk yield per month. Table 1 shows the average productive aspects of each farm during the water monitoring period

This study proposes the performance indicator liters of water per liter of milk (L water L milk^{-1} day^{-1}).

To develop a model for predicting the average daily water consumption of lactating cows, the following variables were considered: (i) dairy water intake (L animal^{-1} day^{-1}); (ii) Dry matter intake (DMI) (kg animal^{-1} day^{-1}); (iii) Number of lactating cows; and (iv) Milk production (L cow^{-1} day^{-1}).

RESULTS AND DISCUSSION

The highest average water intake of lactating cows was 101.2 L cow^{1} day^{-1}, while the lowest was 78.3 L cow^{1} day^{-1} (Table 1). A significant difference was observed between means ($p < 0.05$). The median intake ranged from 100.0 to 77.8 L cow^{1} day^{-1}.

Moderate correlations were observed between milk yield and dry matter intake (0.5174) and milk yield and number of cows (0.5180). When we analyzed the variable water consumption of cows, it presented weak correlations with milk yield and dry matter intake, 0.3738 and 0.2469, respectively. There was no correlation between water consumption and environmental variables.

Farm 4 presented the best average efficiency of the performance indicator, 2.4 L water^{-1} L milk^{-1} day^{-1}. For the other farms, the average varied from 3.0 to 3.6 L water^{-1} L milk^{-1} day^{-1}. The highest average of the indicator was observed on farm 2, 3.6 L water^{-1} L milk^{-1} day^{-1}. This farm also had the highest maximum value, 6.7 L water^{-1} L milk^{-1} day^{-1}.

The proposed model to estimate water consumption of lactating cows in compost-bedded pack barns is presented in Equation 1:

$$DWI = 54.5075 + 0.7823 * DMI + -0.3785 * COW + 1.4054 * MY + 0.0110 * Tcmed + 0.0266 * Urmed + 0.2045 * Tcmax + 0.0240 * Urmax \quad (Eq. 1)$$

where DWI = dairy water consumption (L cow^{-1} day^{-1}), DMI= dry matter intake (kg animal^{-1} day^{-1}), COW= number of lactating cows, Tcmed= average temperature (°C), Tcmax= maximum temperature (°C), Urmed= average humidity (%), Urmax= maximum humidity (%).

The proposed model explained 27.8% of the variability in water consumption. The MAE (9.92 L day^{-1}), MSE (160.21) and RMSE (12.66 L day^{-1}) values of the proposed model presented the lowest values, indicating that the predictions of this model were the closest to the real values.

CONCLUSIONS

The results indicate that the average daily water intake ranged from 78 to 101 L water cow^{-1} day^{-1}, with factors such as milk yield and dry matter intake exhibiting a weak correlation with water consumption, while no correlation was found with climatic variables. The indicator of liters of water per liter of milk varied from 2.5 to 3.6 L water L milk day^{-1}. The differences observed between farms can be attributed to the levels of milk yield.

Furthermore, this study proposes a mathematical model to predict the daily water intake of lactating cows in compost-bedded pack barns. The model proposed in this study accounts for a significant portion of the variation in water consumption (27.8%), surpassing existing models in the literature across all evaluation metrics. Consequently, this proposed model represents a substantial advancement in the prediction of daily water consumption by lactating cows in a compost-bedded pack system.

ACKNOWLEDGMENTS

To the four dairy producers and technical advisors who contributed to the monitoring of water consumption during the period from 2021 to 2025.