

Abstract

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Udder health in cows reared on bedding made of manure solids and mineral additives

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An economic analysis of the farms has turned out to be the key aspect of managing individual entities and large agricultural integrator companies. Increasingly restrictive environmental standards have been triggering growing operational costs for dairy farms in Europe and worldwide, which has resulted in a reduced number of farms and decreasing cattle inventory. However, state-of-the-art breeding technologies, such as genomic tests and embryo transfer, have brought about rapid genetic progress, which results in continuously growing milk production from a cow. Improved husbandry in cattle facilities has also been a substantial factor impacting the increase in milk yields. Cow welfare and extremely high requirements for cow comfort play a key role in production and health. Targeted measures and transformations on cattle farms determine cow longevity and consequently improve profitability. For high-yielding animals, the time spent in comfortable, clean, and dry cubicles constitutes a fundamental part of optimal cattle husbandry and has a direct impact on cows' health, with the latter determining milk quantity and quality and as a result, guiding the profit margin of dairy farms. Deprived of rest, dairy cattle suffer from impaired physiological functions, which worsen general health and increase culling rates due to deteriorated health. A type of bedding in cubicles can improve cow comfort and stimulate the animals to rest; furthermore, it is also a key factor for the length of time spent on resting, the cleanliness of cows, and the number of mastitis cases and leg injuries.

The scientific objective of the studies was to determine the impact of manure solids (called SEPARAT) with mineral additives used in cubicles on cow and udder health and the quality and quantity of milk. The practical objective was to assess the effectiveness of mineral additives used with pure manure solids as cubicle bedding in improving resting comfort and securing adequate hygiene of cubicles.

The studies were conducted in 2018-2020 on three commercial farms owned by Przedsiębiorstwo Rolniczo – Hodowlane „Gałopol” Sp. z o.o. Gałowo and supervised by the National Support Centre for Agriculture. During the first study phase, the investigated animals were grouped per lactation number and kept in the cubicles with pure bovine manure solids bedding without minerals while in the second study phase, the manure solids formulation was mixed with the KSM Kalk lime. The comparative farms included Gospodarstwo Rolne Lisiecty owned by Elżbieta and Tadeusz Lisiectki and Paul Polska Sp. z o.o. owned by the Pauls family. On the Lisiecty farm, the cows were kept in cubicles with bedding made of a straw, lime, and water mixture (called straw-lime mattress) for the whole study period, whereas on the Paul Polska farm, the animals were kept on sand bedding in the first and second study phase. Milk yield and composition, including somatic cell count (SCC), were analysed in milk from the cows housed on the above-mentioned farms. Since the rationale for using bovine manure solids with mineral additives as cubicle bedding for dairy cows was a key aspect of the studies together with the impact of the bedding on cow comfort and udder health, the study analysis focused both on SCC in milk and microbiological examinations of milk with high SCC. Qualitative and quantitative production data was taken from the table reports on monthly monitoring of dairy production parameters in the investigated herds. The manure solids formulation used to cover the cubicles on the study farm (Przedsiębiorstwo Rolniczo – Hodowlane „Gałopol” Sp. z o.o. Gałowo) was also analysed for a microbiological profile.

Based on the studies, it was concluded that the highest milk production was reported on the B farm where the bedding was a mixture of straw, lime, and water (straw-lime mattress); also there, the SCC values were lowest in milk harvested in both study phases compared to the other investigated farms. For the first study phase, the difference in milk production was close between the A farm, where the bedding was a mixture of manure solids with the KSM Kalk lime and the C farm with sand bedding. Based on the author’s studies, it was demonstrated that in the first phase of the studies, the difference

in milk SCC between the best farm and the worst one was 85,920 and significantly below the permitted 400,000-cut-off value for the extra milk category. During the second phase of the studies, a substantial increase in SCC by nearly 50% was recorded on the A farm where the manure solids bedding without mineral additives was used, whereas on the other farms, a reduction in the SCC values was demonstrated for the same period. Interestingly, despite the significant increase of SCC in milk from the A farm cows, a minor rise in milk production and protein content was reported.

The analysis of the results for the following months of the studies revealed that the highest increase in the somatic cell count was demonstrated in May and June, which coincided with a drop in milk production compared to the winter and spring months. The highest SCC level of 700,660 was reported in May in the second phase of the studies on the A farm where the animals were reared on the manure solids bedding without lime. For the analogous month in the first phase of the studies and the same A farm, the concentration of SCC in milk was lower by 291,300, and milk production was higher by nearly 3.5 kg. The only difference was the addition of lime in manure solids in the first phase of the studies. Based on the author's studies, it was shown that apart from the SCC levels in warm months, there were some significant reductions in rumination time regardless of age and lactation number. A relationship between SCC and rumination was demonstrated for both study phases, with the high SCC animals having the lowest rumination rates.

The microbiological examinations and analyses revealed that the application of lime significantly reduced the numbers of Gram-negative *Escherichia coli* and *Serratia marcescens*. Lime proved remarkably effective against *Aerococcus viridans* (a causative agent of mastitis) and the other streptococci. *Acinetobacter indicus*, *Psychrobacter sanguinis* and *Stenotrophomonas maltophilia* were resistant to lime. Moulds and algae were only occasionally isolated. However, lime was ineffective against the latter and *Str. uberis* (environmental streptococcus) and *Enterococcus saccharolyticus* (faecal bacterium).