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IN THIS ISSUE:
Limestone ($CaCO_3$) used as a conditioner in different bedding materials used by dairy cows.

This issue of Mineral Writes will examine cow comfort and udder health. We will examine the efficacy of lime-based conditioners against environmental udder pathogens in various bedding materials. Research indicates that increased periods of lying down are positively correlated with higher milk production. It is essential, then, to provide the cow with a clean, dry environment in which she can lie down. This raises concern regarding udder health, specifically mastitis, which costs the dairy industry billions of dollars each year. Mastitis can be categorized into two types based on its mode of transmission: contagious or environmental. Focusing on environmental factors that cause mastitis and the pathogens involved, the emphasis should be on prevention, specifically regarding bedding. Dairy producers have a variety of options for freestall bedding, which includes both organic and inorganic materials.

Organic materials consist of compost, paper, sawdust or wood shavings, and straw; inorganic materials include sand and limestone-based conditioners.

Sand is presented as the ideal "gold standard" due to its cleanliness, dryness, comfort, and inherent resistance to bacterial growth, making it an inorganic material. Sawdust**,** the second most common, is an organic material that can harbor bacteria, especially when "green" (undried). Kiln-dried sawdust is recommended to reduce bacterial issues and improve moisture absorption. Dried manure solids (RMS) are a more economical organic alternative but tend to support higher bacterial levels compared to sand, recycled sand, sawdust, and shavings. The bacterial composition of RMS varies depending on the processing method. To mitigate bacterial growth in RMS, thorough drying and frequent replacement are crucial. Maintaining dryness in deep-bedded stalls using RMS can be challenging, often resulting in higher bacterial counts.

A great inorganic source is pure limestone ($CaCO_3$), which is naturally neutral, with a pH of 7, due to its limited solubility in pure water. The size of limestone particles plays a crucial role in how effectively they influence pH. Finer limestone particles, characterized by a larger surface area, exhibit a significantly faster reaction rate, leading to a more rapid increase in pH. Very fine particles, capable of passing through a 100-200 mesh screen (less than 150μm), can react almost completely within a few days to weeks. While finer particles facilitate a quicker pH increase, studies suggest they can also achieve a higher maximum pH over time compared to coarser particles. Conversely, very coarse particles, larger than 850μm or coarser than 20 mesh, are practically unreactive and have minimal to no impact on pH. Medium-sized particles, ranging between 150 and 850μm (or 20 to 100 mesh), react more gradually, which helps maintain a stable pH over a more extended period. Furthermore, finer limestone is more efficient, requiring less material to achieve the same pH increase compared to coarser limestone due to its enhanced reactivity.

In a study conducted by Sara Fusar Poli et al. (2025), the objective was to examine the effectiveness of a commercial Lime-Based Conditioner (LBC) in managing pathogen growth and enhancing the physical and chemical properties of Recycled Manure Solids (RMS) bedding for dairy cows in a laboratory environment.

The research demonstrated that untreated RMS bedding displayed high and often rising bacterial levels over time. However, applying LBC resulted in a reduction of total bacterial count (TBC), as well as gram-negative bacteria, coliforms, E. coli, and Staphylococcus species (SSLO), with the decrease being more pronounced as LBC concentrations increased.

This antibacterial performance is linked to LBC's capability to elevate the bedding pH into the alkaline range and enhance the dry matter (DM) content of the bedding. An elevated pH is associated with the inhibition of bacterial growth, while increased DM lowers the moisture available for bacterial growth.

Although the pH of the treated bedding declined over time, bacterial recovery was slower at higher concentrations of LBC, indicating a lasting effect. The research also noted a consistent rise in DM content corresponding to increasing levels of LBC.

The authors conclude that LBC presents a promising option for controlling environmental bacteria and advancing the physical-chemical properties of RMS bedding. However, they warn that these findings are based on laboratory conditions, and field studies are essential to confirm these results, evaluate the safety of LBC levels for cows (considering potential issues like ulceration associated with hydrated lime), and address real-world factors such

as contamination from feces and urine. This research provides a basis for future on-farm studies to assess the effects of varying LBC concentrations on bedding, the risk of mastitis, and cow health.

ILC Resources in the 1950s, developed Dairy-White ® Barn Lime, a premium product developed by designed to utilize the natural benefits of high-calcitic limestone for a variety of essential farm and barn applications. This versatile product originates from the same top-quality limestone utilized in livestock and poultry feed supplements, ensuring safety and effectiveness.

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For more information, please visit www.ilcresources.com.

References

1. Sara Fusar Poli, Gustavo Fre, Leticia Lohana dos Santos, Renata Piccinini, Valerio Bronzo, Gloria Gioia, Paolo Moroni, Maria Filippa Adis. (2025) Efficacy of lime-based conditioner against environmental udder pathogens in different bedding materials. Veterinary and Animal Science, https:/doi.org/10.1016/j.vas.2025.100459

For questions or to receive Mineral Writes electronically, contact:

DENICE PFLUGRATH, MS, PAS Director of Nutrition and Technical Services
denicep@ilcresources.com
(515) 243-8106
FAX: (515) 244-3200

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