

Investigation of the relationship between manure processing method and levels of mastitis pathogens in recycled manure solids bedding on Midwest dairy farms

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Introduction

While many dairies use green (GRN) recycled manure solids (RMS) bedding, some first process slurry through an anaerobic digester (DIG), while others have adopted secondary (SEC) processing methods such as mechanical composters (COM), hot air dryers (DRY) or, more recently, infrared drying (IR), in an effort to lower mastitis pathogen counts in ready to use (RTU) solids. A previous study reported that Midwest herds using DIG as the sole processing method had lower levels of coliforms and *Klebsiella* spp. (Kleb), but no reduction in streptococci or strep-like organisms (SSLO) in RTU solids, and no improvement in udder health, as compared to herds using GRN RMS. In contrast, herds using COM or DRY RMS bedding had lower bacteria levels and improved udder health as compared to herds using GRN solids. However, the latter study included a limited number of herds using DIG RMS. The objective of this observational study was to investigate the relationship between use of DIG and other SEC processing methods and levels mastitis pathogens in RTU RMS, as well as bulk tank (BT) SCC, when compared to herds using GRN RMS bedding.

Materials and methods

Twenty-seven dairy premises in Minnesota and Wisconsin were recruited to achieve a sample of different processing methods including GRN (n = 6), COM (n = 3), DIG (n = 9), DIG-DRY (n = 6), DIG-IR (n = 1), and DRY (n = 2). Premises were visited once in summer 2021 to collect slurry and bedding samples before and after each processing step within the system. Solids samples were submitted to the Laboratory for Udder Health (UMN) for aerobic culture to determine counts of coliforms, Kleb, SSLO, and staphylococci spp. (Staph) (cfu/cc, wet basis). Farms were categorized into one of four types of processing systems: GRN (n = 6), DIG only (n = 9), SEC only (n = 5), or DIG+SEC (n = 7). After log-transforming (log₁₀) both solids sample bacteria counts and BT SCC data, linear regression was used to compare counts of coliforms, Kleb, SSLO and Staph in RTU solids samples, and to compare BTSCC, between the 4 categories of systems evaluated. Models offered to control for breed and herd size, but they were not retained in final models. Multiple comparisons were accounted for by using Tukey adjustment.

Results

Compared to GRN RTU solids (4.53(0.72)), mean (SE) coliform counts were statistically lower for DIG+SEC samples (1.53(0.67) $P = 0.02$), and were numerically, though not statistically, lower in DIG (3.29(0.59), $P = 0.55$) or SEC (3.04(0.79), $P = 0.51$) samples. Levels of Kleb were lower in DIG (0.52(0.33), $P = 0.053$), SEC (0.0(0.43), $P = 0.016$) and DIG+SEC (0.0(0.37), $P = 0.0008$) as compared to GRN RTU solids (1.93(0.40)). Counts of SSLO were lower in DIG+SEC RTU samples (2.38(0.50) as compared to either GRN (5.61(0.54), $P = 0.001$) or DIG (4.99(0.44), $P = 0.004$) RTU samples, and numerically, though not statistically, lower than for SEC samples (4.08(0.59), $P = 0.16$). Staph counts were very low in GRN samples (0.0(0.28)), and were not different than for DIG (0.19(0.23)), SEC (0.64(0.30)), or DIG+SEC (0.0(0.26)) samples (Type III P value = 0.39). Mean BT SCC (log₁₀) counts were lower for farms using DIG (2.11(0.05)), SEC (2.22(0.06)) or DIG+SEC (2.12(0.05)) RMS compared to those using GRN RMS bedding (2.58(0.06)) ($P < 0.001$).

Significance

Ready to use solids samples from herds using either anaerobic digestion or secondary processing of RMS had lower bacteria counts for 1 or more mastitis pathogen groups, as compared to samples from herds using GRN RMS bedding. However, of all the systems evaluated, the use of a combination of DIG plus a SEC system generally resulted in the lowest bacteria counts in RTU solids. The ability of these processing systems to reduce mastitis pathogen counts may contribute to why these herds observed lower BT SCC as compared to herds using GRN RMS bedding. Larger studies are needed to more extensively evaluate the biological and economic impacts for all of these RMS processing systems, and the newer IR systems in particular.

