

# Investigation of the relationship between method of processing recycled manure solids bedding and udder health and production on Midwest dairy farms

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## Introduction

There has been a rapid increase in adoption of recycled manure solids (RMS) as bedding in Midwest dairy herds over the past 10 to 15 years due to perceived advantages such as cost and availability. Several studies have reported increased bedding bacteria counts (BBC) and increased mastitis risk in herds using RMS as compared to inorganic or organic non-manure materials. Although many RMS dairies use either green/raw (GRN) solids or solids first processed through an anaerobic methane digester (DIG), some herds have adopted mechanical composters (COM) or dryers (DRY) in an effort to lower BBC and control mastitis. Research is needed to evaluate potential benefits and costs of adopting these technologies. This research team initiated a study to evaluate udder health, air quality, antimicrobial resistance in solids, and economics, for herds using different RMS processing methods. The objective of this portion of the study was to investigate if method of processing RMS is associated with udder health and milk production on Midwest dairy farms.

## Materials and Methods

This observational study was conducted with a convenience sample of 29 free-stall premises in MN and WI. Farms were recruited to achieve a representative sample of different processing systems including GRN (n=7), COM (n=4), DIG (n=6), and DRY (n=12). Premises were visited twice, once in Aug-Sept, 2019, and again in January 2020, to collect bedding samples, electronic herd records, and to complete a management questionnaire describing facilities and management, including but not limited to manure and bedding management, milking procedures, and mastitis control practices. Udder health and performance metrics captured from the DHIA test day preceding each herd visit included average 305ME (kg/cow), test day average linear score (AVLS), the proportion of cows with an intramammary infection (IMI) where infection was defined as  $LS \geq 4.0$ , the proportion of cows with a new IMI (NIMI) where a new IMI was defined as LS changing from  $< 4.0$  to  $\geq 4.0$  in the last 2

tests, and the proportion of cows with a chronic infection (CRON) where chronic was defined as a  $LS \geq 4.0$  on the last 2 tests. The monthly cumulative incidence of clinical mastitis (CLXM) was also recorded for the 30-d period preceding sample day. Mixed linear regression was used to describe the relationship between bedding processing system and the following dependent variables: AVLS, IMI, NIMI, CRON, CLXM, and 305ME. Other covariates offered into models, if significant, included herd size, avg DIM, avg parity, season, ventilation quality, bedding and manure management practices, and mastitis control practices. Herd was controlled for as a random effect. Overall significance was set at  $P < 0.05$ , with a trend at  $0.05 \leq P < 0.10$ . However, the critical P value was adjusted for multiple contrasts.

## Results

Of 56 herd visits conducted, DHIA test day information and clinical mastitis treatment records were available for 43 and 39 visits, respectively. The median (range) number of cows milking was 1,261 (235 – 5,467). Although results varied by processing method, RMS processing system was associated with AVLS, IMI, CRON, and 305ME, but not CLXM. Specifically, the adjusted mean AVLS ( $\pm$  SE) was lower in herds using DRY, and tended to be lower in COM, as compared to herds using GRN solids, but with no difference between DRY and COM (DRY = 2.12 [0.17], COM = 2.15 [0.26], DIG = 2.63 [0.22], GRN = 2.89 [0.16], Type 3  $P = 0.006$ ). The percent of cows with IMI was lower in herds using DRY, and tended to be lower in COM, as compared to GRN solids, but with no difference between COM and DRY, or between DIG and GRN (DRY = 17.31 [2.32], COM = 14.46 [4.64], DIG = 23.82 [2.97], GRN = 25.92 [2.15], Type 3  $P = 0.015$ ). The percent of cows with CRON was lower in herds using DRY, and tended to be lower in COM, as compared to DIG or GRN solids, but with no difference between COM and DRY, or between DIG and GRN (DRY = 8.66 [1.61], COM = 8.59 [3.28], DIG = 14.95 [2.06], GRN = 16.10 [1.50],  $P = 0.003$ ). Though NIMI was numerically lower for herds using DRY or COM as compared to GRN solids, differences were not significant (DRY = 9.02 [1.55],

COM = 9.78 [2.88], DIG = 13.10 [2.02], GRN = 12.84 [1.47], Type 3 P = 0.15). Finally, Avg305ME (kg/cow) was higher or tended to be higher for herds using DRY as compared to GRN or DIG solids, respectively, but with no difference between DRY versus COM, or between DIG versus GRN (DRY = 13,781 [402], COM = 12,752 [804], DIG = 12,517 [510], GRN = 11,689 [430], Type 3 P = 0.02).

### Significance

In conclusion, preliminary results show that Midwest herds using mechanical drying or mechanical composting

systems to process RMS generally had improved udder health and, for DRY, improved milk production, compared to herds using digested or green solids. Future analysis will explore if udder health or production differences may be explained by differences in bedding hygiene for the 4 processing systems investigated, and will evaluate the economics of adopting different RMS processing systems.

## Investigation of the relationship between method of processing and bacteria counts in ready-to-use recycled manure solids bedding on Midwest dairy farms

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### Introduction

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health and milk production as compared to GRN. In this abstract, we explore if these benefits are likely to be explained by differences in bedding characteristics, such as BBC, for the 4 processing systems investigated. The objective of this portion of the study is to investigate if method of processing RMS is associated with BBC in ready-to-use (RTU) RMS on Midwest dairy farms.

### Materials and Methods

This observational study was conducted with a convenience sample of 29 free-stall premises in MN and WI. Farms were recruited to achieve a representative sample of different processing systems including GRN (n=7), COM (n=4), DIG (n=6), and DRY (n=12). Premises were visited twice, once in Aug-Sept, 2019, and again in January 2020, to collect bedding samples, electronic herd records, and a management questionnaire describing facilities, manure and bedding management, and other practices. At each visit, post-processed