

Propane-Powered Dairy Bed Sanitization

A simple, cost-effective method to reduce pathogens and improve milk quality

airy producers constantly battle mastitis, an infection and inflammation of the cow's udder that reduces milk production and milk quality. Mastitis-causing pathogens can be transmitted from infected cows or from the environment through contaminated bedding.

To combat this problem, most dairies employ sand bedding because it supports the least bacterial growth. However, when contaminated with animal waste, even sand can harbor infectious pathogens. Dairy producers commonly remove organic matter manually and rake sand bedding daily to improve cow comfort, using rakes that are often attached to skid steers or small tractors. While this method is the most successful at reducing mastitis among dairy herds, infections remain a significant and expensive problem for dairy producers.

Researchers at Mississippi State University are currently testing the use of a propane-powered flame sanitizer to reduce pathogens in dairy beds. Already proven as an effective method for sanitizing poultry houses (see sidebar), this technology concentrates extreme heat onto sand bedding, which effectively kills pathogens by rupturing their cell walls, and removes moisture from sand bedding to inhibit bacteria re-growth. By flaming bedding during their routine raking practice, dairy producers can reduce mastitis pathogens by up to 30 percent. Additionally, while other methods of pathogen reduction can leave chemical residue in milk, flame sanitization will not affect milk quality.

Propane-fueled flame sanitization offers dairies that utilize sand bedding systems a low-cost method to help reduce the persistent problem of mastitis infection. The technology also introduces an additional use for propane on the farm that can increase off-peak demand in the summer, when warm and moist conditions are especially conducive to fueling bacteria growth.

Poultry House Sanitization Leads the Way

Propane flame technology has already shown great promise as a method for sanitizing poultry house litter. In field tests, the poultry flamer proved that it:

- Effectively kills mold, yeast, salmonella, E. coli, coliform, and other pathogens
- Increases the effectiveness of treatment, as pathogens cannot become resistant to heat
- Boosts bird health by reducing ammonia levels

In addition to eliminating pathogens, propane flame technology also reduces the need for chemical sanitation. This eliminates the risk of chemical spills, contamination, runoff, and residues.



Project Description

To test the effectiveness of flame sanitization in reducing mastitis pathogens, the Propane Education & Research Council (PERC) initiated a research effort, *Dairy Bed Sterilization Through Propane Flame* (**Docket 12292**). The main goals of the project are to:

- Fit a commercial raking system with propane flame technology.
- Test the ability of flame sterilization to reduce mastitis pathogens in sand bedding.
- Determine optimal speed, BTU output, and frequency of flame treatments.
- Evaluate the impact of the technique on the incidence of mastitis in lactating cows.
- Perform an economic analysis to characterize cost savings.
- Explore commercialization possibilities for a kit to retrofit propane burners on raking systems.



For more information on this and other research projects, go to www.propanecouncil.org/rd



The Cost of Mastitis Infections

Mastitis infections reduce how much milk a cow produces and the quality of the milk, resulting in a steep loss of profit. One study estimated that each case of mastitis costs dairy producers \$181 per cow (\$2 billion annually in the United States), and the price of treating mastitis infections only adds to this already high cost.

A propane flame solution can not only help farmers recoup these losses, but it can decrease the dairy's use of antibiotics as well. Thus, this technology serves as a viable tool for organic producers and also benefits health-conscious consumers.

Project Implementation

The propane-fueled flame sanitizer prototype consists of two to four Flame Engineering burners attached to an existing Dowdy's rake grooming system. The propane tank is attached to the tractor. Testing was performed to evaluate the efficacy of the technology.

Preliminary Pathogen Reduction Trial

To determine if the flame treatment system would reduce the number of pathogens in sand bedding, researchers spiked sand samples with pathogenic bacteria and raked them with the flaming system at 3 mph with various heat settings. Sand was tested for bacteria both before and after raking. These tests showed that flame treatments can reduce pathogens and moisture in sand by up to 30 percent.

Lactation Trial

In collaboration with North Florida Holsteins, a working dairy, a 10-week trial was initiated in summer 2007 using three of the dairy's barns, which house more than 2,500 cows. Both sides of the barn were raked three times a day, but one side was also flamed once a day during raking. The barns were cooled with high-pressure misters, which increase moisture in the bedding. The trial tested for:

- Bacteria in the sand Samples were tested from both flamed and control areas, and the cultures were used to determine the identity and populations of mastitis pathogens.
- Incidence of mastitis Every 30 days, all cows were monitored with Dairy Herd Improvement tests, which check the cow's somatic cell count (SCC). A high count indicates a mastitis infection. Milk samples

were cultured from all cows with high SCC to identify the infectious organisms present on the site.

 Milk quality - Milk production was monitored daily, and milk samples were taken monthly to test for changes in milk composition.

Project Status: In Progress

Testing was completed in summer 2007, and the impact on milk quality and production is currently being determined. Infection rates are also being analyzed. Preliminary conclusions include:

- One flame application can reduce the number of pathogens in the top inch of bedding. With further applications, and as bedding mixes, pathogen reduction occurs deeper.
- Existing raking equipment could easily be fit with propane burners.
- By reducing the cases of mastitis and the associated costs, the equipment could pay for itself in less than a month.

Next Steps

As infection and milk production rates are analyzed, they will reveal the effectiveness of the propane flaming tool in reducing mastitis infection and the associated monetary losses from decreased milk production. Production capability must also be determined for a propane flame kit to retrofit on existing rake systems.

Flame Units Attached to Raking System



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Project Partner:

Mississippi State University

Terry R. Smith Assistant Professor Animal and Dairy Science Mississippi State University Wise Center, Room 4025 Mississippi State, MS 39762 662-325-8773

For More Information:

Propane Education & Research Council Mark Leitman Director of Agriculture Programs 1140 Connecticut Avenue, Suite 1075 Washington, DC 20036 202-452-8975

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