

Developing methods to assess risk to crops exposed to animal facility fugitive dust

Summary

Zoonotic bacterial pathogens have been detected in “fugitive dust” associated with concentrated animal feeding operations (CAFOs) and this dust may lead to produce contamination. Growers may be asked to utilize setback distances for low-density animal operations while limited data or tools exist to determine risks associated with bacteria-containing fugitive dust from low-density operations. This study aims to evaluate methods suitable for detection of bacterial indicators in fugitive dust generated by low-density animal operations. Factors to be studied include distances bacterial indicators travel in dust and how operational factors influence dust release. The contamination level of crops grown near animal operations will also be evaluated to determine crop-specific risk factors as well as correlate detection of indicator bacteria on crops to detection in environmental samples.

Objectives

1. Determine the influence of operational factors of a low-density animal operation on the generation of fugitive dust.
2. Evaluate the presence of indicator organisms in environmental samples associated with a low-density animal operation and compare to detection in three types of produce to determine role of crop characteristics in contamination.
3. Develop risk assessment criteria and methods to mitigate risks related to low-density animal operation generation of fugitive dust.

Methods

At each sampling date, environmental data (air temperature, humidity, precipitation, wind direction, and wind speed) are collected. Passive air sampling for microbial indicators and air particulate monitor measurements will occur at distance intervals of 5, 15, 30, 100, 500, and 1200 feet from animals in four directions at each sampling date. Twenty-five pen surface material (fecal) samples will be collected at each sampling date. Three crops (tomato, cantaloupe, and bell pepper) will also be grown in proximity to animals to determine how crop type affects susceptibility to fugitive dust contamination. Samples will be processed for quantification of aerobic counts, coliforms, and *E. coli* through culture-based methods and generic *E. coli* and *Bacteroides* through qPCR analysis.

Results to Date

Passive air samples were collected in three directions (North, West, and South) (Figure 1) within 30 feet of 178 head of cattle held for approximately two hours in holding corrals. Before enrichment, up to 3.5 log CFU/mL of aerobic bacteria, 1.3 log CFU/mL of coliforms, and 1.1 log CFU/mL of *E. coli* were enumerated in passive air samples (Figure 2). After enrichment, these values increased by approximately 5-7 logs, up to 8.8, 8.3, and 8.4 log CFU/mL for aerobic bacteria, coliforms, and *E. coli*, respectively. Cattle fecal material averaged 2.4 log CFU/g of coliforms and 4.5 log CFU/g of *E. coli* before enrichment (Figure 3). After enrichment, coliforms increased to 6.9 log CFU/g and *E. coli* to 8.5 log CFU/g.

Benefits to the Industry

This study aims to evaluate risks associated with the release of fugitive dust from low-density animal operations. By collecting data on animal facility operations and coupling this with environmental data, as well as microbial data in air, pen surface materials, and produce, a more nuanced approach to the application of setback distances may be derived based on these multiple factors. This data can be utilized to guide appropriate recommendations for growers in relation to low-density cattle operations. Should correlations be drawn between detection of microbial indicators in passive air samples and measurements of air particulate matter, this could be used as a tool to inform risk management decisions as these are relatively low-cost and could have potential for use in field applications.



Figure 1. Aerial view of Sierra Foothill Research and Extension Center with region of low-density cattle confinement highlighted

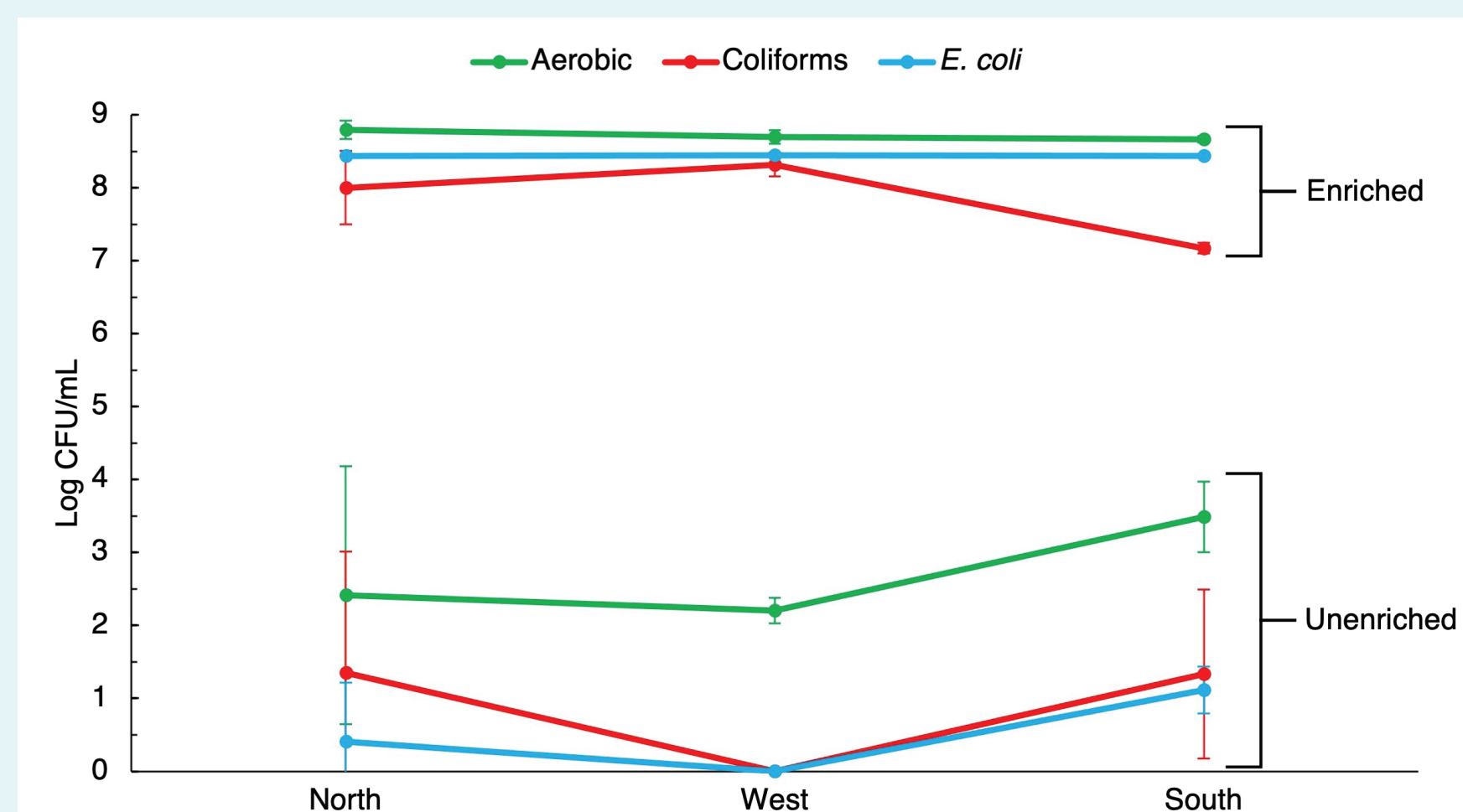


Figure 2. Aerobic bacteria, coliforms, and *E. coli* recovered before and after enrichment from passive air samplers deployed in three directions within 30 ft of low-density cattle operation

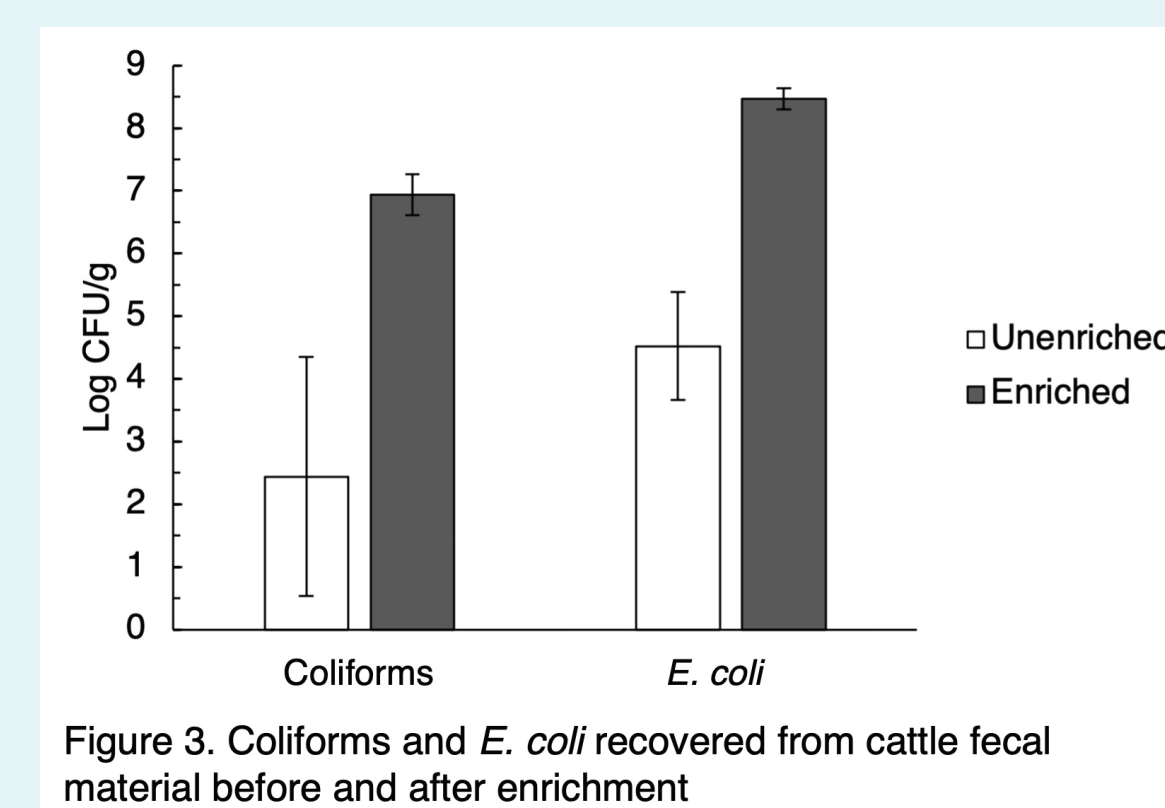


Figure 3. Coliforms and *E. coli* recovered from cattle fecal material before and after enrichment



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