

An ongoing study indicates that storage without fresh manure addition results in significant pathogen reduction, but the holding times required are longer under colder conditions.

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Reducing pathogens through better manure storage management

Identifying which year-round manure storage practices reduce pathogen loads more effectively than others would be very valuable for Ontario livestock producers. Providing farm-based data for the presence, persistence and amount of various pathogens in stored manure is essential for developing management practices that afford the best possible protection for both surface water and groundwater.

Ann Huber, an environmental microbiologist at the Guelph-based Soil Resource Group (SRG), continues to lead an ongoing study to examine the effect of different storage conditions on the survival of pathogens in several different types of manure. Established in 1998, SRG is a resource management consulting firm which conducts pure and applied agri-environmental research.

"Methods for examining pathogen decline within farm-scale storages were developed and verified in the first year of the project," says Huber. "We also developed methods for sample removal from specific locations within the storage systems without disturbing the rest of the manure."

A number of swine, dairy, beef, and poultry producers with appropriate manure and storage systems have been co-operating to provide access to their liquid swine and dairy manure, as well as solid dairy, beef and poultry manure. For each manure type, Huber and her colleagues have been comparing how "typical" and "modified" storage systems fare in terms of which and how many particular pathogens are present and how long they are able to survive.

"With swine and dairy liquid manures, we are examining static versus periodic addition of fresh manure," says Huber. "For dairy solid manure, we are looking at separate storage of calf bedded pack and milking herd solid manure. In poultry solid, it's

storage under roof cover and outside, and in beef solid, we are comparing covered versus uncovered outside piles."

The pathogens studied include *E. coli*, *E. coli* O157, *Salmonella* and *Cryptosporidium*. Manure samples were also analyzed for dry matter for each sampling period. Nitrogen, phosphorus, potassium and ammonium-nitrogen tests were conducted at the beginning and end of each trial. Two winter and two summer trials have been completed at this point.

"We found that storage of swine manure without fresh manure additions results in substantial pathogen die-off compared to the more common practice of continuous or periodic fresh additions," says Huber. In other words, if possible, it is better to store liquid manure without adding fresh manure as it allows for effective reduction in most pathogens.

"The time required to reach at least a significant pathogen population reduction is much greater in winter than during summer months," notes Huber. "Decline rates are temperature driven, and freezing conditions tend to maintain most pathogen populations rather than reduce them." Similar conclusions were arrived at for the liquid dairy manures systems under

study. For solid manures, temperature is the most important factor in pathogen reduction. Dry matter content, which allows for good heating of the manure piles in summer or winter, plays a crucial role.

"We found that the poultry litter in this study heated up very rapidly in both summer and winter trials," says Huber, "to the extent that both *E. coli* and spiked *Salmonella* spp. declined to below the detection level by the first sampling time – three to seven days – for all four.

"Overall, we see that the difference between indoor and outdoor storage for poultry litter is negligible for pathogen die-off rates," she adds. "However, dry matter content remains higher in the indoor stored manure and there is more nitrogen retention in indoor stored manure."

Results from the dairy solid trials indicated that storing calf manure (sawdust-based, bedded pack) separate from the milking herd manure (straw-based, conveyer) results in much greater composting and more rapid decline of organisms to below detection level. With regard to solid beef manure piles, Huber's team found that covering solid beef manure did not make a substantial difference in pathogen die-off rates.

Taken as a whole, this research found that for liquid swine and dairy manures, storage without fresh manure addition results in significant pathogen reduction, but the holding times required are longer under colder conditions.

"For solid manures, if farmers store manures for extended periods, even uncovered and without turning, there is substantial pathogen die-off," says Huber. "However, die-off is much faster in summer than winter, unless significant heating is taking place."

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