Potatoes & Manure

 Researchers discover they do mix

By Jeffery Carter
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Some day, potato growers will be rubbing their hands together in anticipation of the time when their hog farming neighbors have liquid manure ready to spread on their ground. That may sound fantastic. After all, the textbooks suggest potatoes and manure do not mix.

Not so, says George Lazarovits who wants to rewrite the textbooks. He envisions a day when liquid swine manure will be viewed in a more positive light - as a pathogen killer, soil energizer and nutrient source.

“I think the problem is that we treat manure like a disposable waste - I want to change that,” he says. Lazarovits and his Agriculture and Agri-Food Canada research team at the Southern Crop Protection and Food Research Center in London, Ontario have discovered that organic amendments such as liquid swine manure can control disease in crops and at the same time build the populations of “good” soil life. Practical applications for the strategy are likely in a year or two, they think.

“Although organic amendments reduce populations of plant pathogens, overall they lead to an increase in soil microbial populations by up to 1,000-fold following application,” Lazarovits says. “As we unravel the potential benefits of organic treatments, there is indication that they may return as a valuable tool in disease management strategies.”

It’s heady stuff. In their investigation of a variety of organic amendments, Lazarovits and his team discovered three years ago that liquid swine manure can control verticillium wilt in potatoes - and probably many other diseases. More importantly, they discovered why it works in some fields but not in others. It’s a function of the soil pH, Lazarovits says.

The field in which the swine manure worked well had a soil pH value between 5 and 5.5. In the fields where the manure had a limited effect the pH values were much higher.
Lazarovits explains that the acetic acid (vinegar) and the other fatty acids in liquid swine manure are only readily available when pH levels of the manure are below 4.9. Consequently, when acidic manure is mixed with higher pH soil, the fatty acids are inactivated.

“Because we know the mode of action, we can now plan on how to use this knowledge in an optimal manner,” Lazarovits says. “By measuring a few soil parameters and setting up simple laboratory assays we can predict whether, and at what rate, a soil amendment can be used to manage plant pathogen populations.”

Lazarovits sees significant potential for commercial applications. Sandier soils tend to have pH levels within the acceptable range for the strategy to work and many of the higher value crops are grown in this type of soil. In addition, the strategy works best in the fall when soil-borne pathogens are dormant and vulnerable and when pH levels are naturally lower by about a point.

Lazarovits suggests the strategy can be taken further by manipulating the liquid manure itself. The first step would involve sterilization by raising the manure temperature through aerobic fermentation. Lazarovits suggests a system that bubbles air through manure prior to lagoon storage. Once sterile, there would be no concerns about human pathogens, and the manure could be inoculated to induce the optimum fatty acid levels.

It’s even possible, Lazarovits speculates, that liquid manure production may become a profitable sideline for livestock farmers. With the pathogen-killing properties of the manure optimized, lower volumes would be required and this would reduce transportation costs. Farmers would also consider the value of available nutrients and the ability of manure to boost the population of “good” soil organisms - promoting healthy soil.

Lazarovits believes the strategy will work for a variety of soil-borne pathogens, bacteria, fungi, nematodes and possibly insect and weed pests, although further trials will be needed. Potatoes were chosen as the test crop for the organic amendment trials because, as Lazarovits says, “they tend to be susceptible to every disease out there.”

Currently, the chemical soil fumigants such as methyl bromide are the only effective means for controlling soilborne plant pathogens. Unfortunately, fumigants have been connected to ozone depletion and some are toxic to all living things, including beneficial soil organisms.

In contrast, liquid swine manure and other organic amendments can help build soil life populations. Lazarovits explains that most soil organisms tend to metabolize the active ingredients
found in such amendments while crop pathogens, which are only active when a host crop is present, can be killed as they lie dormant in the soil.

It was also found that swine manure can control common potato scab, possibly through other mechanisms. That’s a complete contradiction to current literature and recommendations which suggest manure promotes the development of scab. Lazarovits suggests this false assumption may stem from the era when animals were fed potatoes and tended to pass such intact disease organisms as potato scab through their systems.

At the University of Wisconsin, Keith Kelling stumbled upon evidence that supports the findings of Lazarovits and his team. In a trial involving the fall application of liquid cow manure on potatoes last year, Kelling was surprised to find that potato scab was actually reduced, though he cautions the findings are based on just one year of data.

In addition, the potato yield where the manure was applied was significantly higher than where commercial fertilizers were applied. It’s possible, Kelling suggests, that there were more available nutrients in the manure than expected or the manure was having another affect, such as boosting the population of beneficial soil microorganisms.

Lazarovits credits members of his team - including Ken Conn and Mario Tenuta - for much of the work. The work is sponsored by potato grower groups in Ontario and Prince Edward Island, government programs, and Ontario Pork.