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The Challenges of Applying Liquid Manure to Tile Drained Fields

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The installation of subsurface drainage in Michigan over the last century has transformed portions of the state from poorly drained wetland areas into productive agricultural land. Since large scale drainage began in the 1800's over five million acres within Michigan has been drained for agricultural production, mostly in the southern portion of the state. While subsurface drainage has made farming possible, it can also serve as a rapid conduit to surface waters for excess nutrients and contaminants that leach through the soil and reach a drain line.

State-of-the-art liquid slurry injectors allow variable rate applications

A problem that has recently become evident from livestock producers is that under certain circumstances, liquid manure is being applied to tile drained fields and coming out the tile lines. Applying liquid manure to agricultural fields is a common practice in the state of Michigan. This practice has many benefits in that it allows producers to provide fertilizer to agricultural crops while disposing of agricultural waste and meeting the states' zero-discharge regulation. However, there has been evidence from around the state that liquid manure has been noticed discharging from subsurface drainage systems immediately after manure application.

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Agitation provides the slurry with uniform nutrient content

What would cause this to happen? To understand this problem, we need to look deeper in the soil. Soil is of course made up of particles of sand, silt, and clay, but there is also a lot of open pore space within the soil that is necessary for the infiltration of water and transfer of air into the root zone. It is here, within the macropores where we see the root of the problem. Macropores are large spaces within the soil structure. They are caused by natural soil formation processes, old root channels, earthworm and small animal activity, and soil shrinking and cracking. As liquid manure is applied to fields with subsurface drains and

enters a macropore, it can be transported deep within the soil profile. If there happens to be a tile line in the way, it is possible for the manure to enter the tile with little contact with the soil and discharge into a ditch or stream. This phenomenon has been noticed especially in no-till fields, where macropores are common due to the lack of tillage and earthworm activity.



shallow injection with soil disturbance may slow the movement of liquid manure to tile drains

success is the installation of gate valves on the drainage system. This allows the grower to effectively shut of the tile system for a period of time before and after manure application. While some management techniques may prevent liquid manure from reaching tile lines in some situations, there is not a clear cut solution for every farm. To prevent this problem, farmers will be required to do a little experimentation on their own fields and determine what works for their own situation.

To address this problem, MSU researchers in the Agricultural Engineering and Crop and Soil Science Departments along with researchers from Ohio State University and USDA-NRCS and USDA-ARS are working on evaluating alternative management strategies that will reduce the risk of liquid manure reaching tile drains. This problem appears to be a combination of numerous factors, soil type, tillage, application rate and method, manure consistency, and timing. We currently have a field study looking at the effects of tillage over the top of tile lines. Through work done in both Michigan and Ohio, we have found that by incorporating a horizontal tillage practice prior to manure application and reducing the rate of liquid manure is helping to keep manure out of tiles. Another approach that has had some