UMES scientists in collaboration with scientists at Penn State University and USDA-ARS units at University Park, PA and Booneville, AR have collected field and laboratory data to assess the performance of the *Subsurfer,* a novel technology designed to place dry poultry litter below the soil surface. This technique improves water quality by reducing phosphorus, arsenic and nitrogen in surface runoff, increases crop yields, and diminishes the release of ammonia and other odorous gases into the atmosphere that occurs when litter is broadcast.

Development of a Dry Poultry Litter Soil Incorporation Technology to Protect Air and Water Quality

Who cares and why?

The Delmarva Peninsula's poultry industry produces roughly 600 million broiler chickens that generate almost 1-million tons of litter each year. Most of this litter is applied to the surface of local farm soils as a source of cheap fertilizer. Without immediate incorporation into the soil, gases readily volatilize causing significant odor emissions. Complaints lodged to regulators and government bodies about offensive and harmful odors from manures have been increasing dramatically in recent years. In addition, when litter is left on the soil surface, nutrients - especially phosphorus (P) and nitrogen (N) - wash off the soil to streams that feed the Chesapeake Bay. The Chesapeake Bay is the nation's largest estuary, generating almost $5 billion in commercial and sport fishing sales alone. Efforts to improve the health and productivity of the Bay are essential for the economic sustainability of watermen, the seafood industry, tourism, and other stakeholders living within the Delmarva Peninsula.

What has the project done so far?

UMES along with its federal and land grant partners have been at the fore of testing and promoting new manure application technologies to better use valuable nutrient resources in manure while minimizing off site concerns. The UMES led partnership actively sought out options for poultry producers, ultimately recruiting technologies and promoting research to place dry poultry litter below the soil surface, with an eye to improving water quality, increasing crop yields, and minimizing emissions of ammonia and other odorous gases. Unlike liquid manures, no technology existed until recently to place solid manures below the soil surface without tillage. Early research at UMES spurred innovation with a prototype technology evolving into a USDA-ARS invention now affectionately known as the Subsurfer.

The Subsurfer

UMES and ARS-USDA has since involved farmers in evaluating the *Subsurfer* through on-station and on-farm demonstration trials. A joint six-year study was recently completed. The success of these trials has led environmentalists and farmers alike to express an interest in the new technology to assist them in meeting new regulations recently imposed by the state of Maryland *("manures must be immediately incorporated into soil to meet environmentally-friendly*

management"). The *Subsurfer*, designed by USDA-ARS scientist Dan Pote of the Dale Bumpers Small Farms Research Center, Booneville, AR, has a five ton delivery capacity and creates eight rows of trenches 2 inches wide, 3 inches deep, and about 12 inches apart. Rotating augers break up large chunks of litter into a finer material that is then deposited below the soil surface and closing wheels cover the open trenches. This improves water quality as fewer nutrients enter drainage ditches when surface runoff flows from the fields. The *Subsurfer* is presently undergoing engineering modifications to enhance speed, reduce manure caking in the augers, raise litter-to-soil delivery levels, and other features.

Subsurface applied Litter

Litter broadcasted on surface.

Impact/Potential Impact Statement

Research data indicates that *Subsurfer* litter placement increased average corn yields by 30%. In addition, field and lab results show that this technology reduced emissions of odorous gases to the air by more than 90%. Additionally, P and N in runoff, when compared to broadcast and disked treatments, was reduced by as much as 60% depending on environmental conditions and soil type. The *Subsurfer* allows farmers to benefit from the use of poultry litter high in P without increasing the potential for negative environmental impacts. Finally, erosion was lowered by at least 75% since the *Subsurfer* promotes minimum no-till cultivation.

What research is needed?

The *Subsurfer* warrants some engineering modifications to improve its performance and its future acceptance in commercial agriculture. One feature is the speed; another is to be able to successfully apply litter from a broad range of sources. Also, additional studies are needed to determine how to best subsurface apply litter using the *Subsurfer* to offset the possibility of increased movement of P to groundwater.

Want to know more?

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Strategic Priority: Environmental stewardship through sustainable management practices
Additional Links: http://www.umes.edu/ard/Default.aspx?id=46285
Year and Institution: 2014, University of Maryland Eastern Shore

This project was supported by the NIFA-USDA Evans-Allen Program and the UMES Agricultural Experiment Station.