Long-Term Performance Testing of Subsurface Dry Poultry Litter Application Technology

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OVERVIEW

Broadcast application of poultry litter to soils can exacerbate nutrient losses in runoff and leachate. Since 2007, researchers at the University of Maryland Eastern Shore (UMES), Penn State University (PSU), University of Maryland (UMD), United States Department of Agriculture-Agricultural Research Service units at Auburn and Arkansas, and others have been testing a novel technology, the Subsurfer. We evaluated nutrient runoff and leachate, odor emissions and corn yields using various conventional litter application methods (disking, broadcasting), and subsurface application with the Subsurfer. Aggregated across the study period, losses of P and N in surface runoff and leachate did not differ significantly, but differences were observed between the Subsurfer and conventional litter application treatments in some years. The Subsurfer treatment increased average corn yields by 30%, and reduced odor emissions by as much as 92% compared to broadcasting.

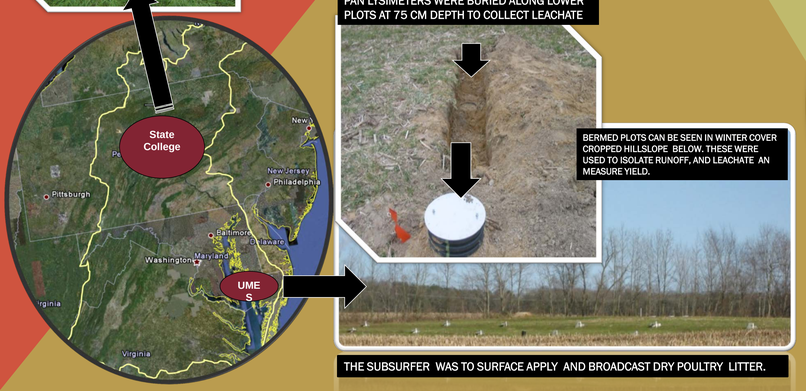
THE SUBSURFER

The USDA-ARS Subsurfer evolved from prototypes that successfully placed dry poultry litter below the soil surface with limited soil disturbance. The technology uses a system of augers to convey and grind dry litter (<25% moisture), and a combination of no-till planting components to incorporate the litter.

MATERIALS AND METHODS

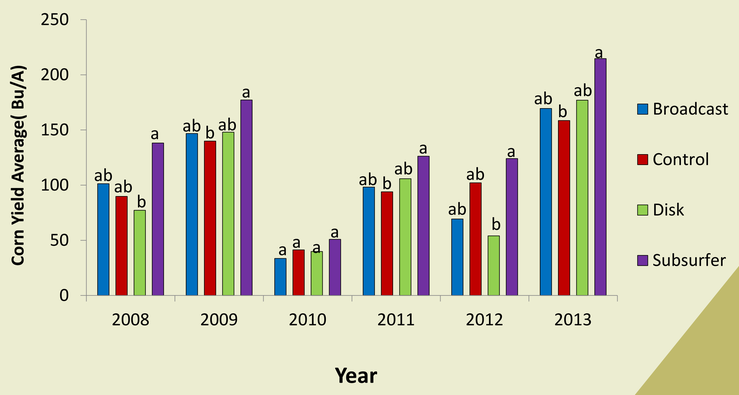
Runoff, leaching and yield studies were carried out on 12, 3 x 9 m plots at the UMES Research and Teaching Farm (Princess Anne, MD). Two Mg/ha of poultry litter was applied annually, either by broadcasting, broadcasting then disking (to incorporate the litter) or subsurface application with the Subsurfer. An un-amended treatment served as the control.

Odor studies were carried out on the Penn State Research Farm at State College PA before and after broadcast or subsurface litter application.



RESULTS AND DISCUSSIONS

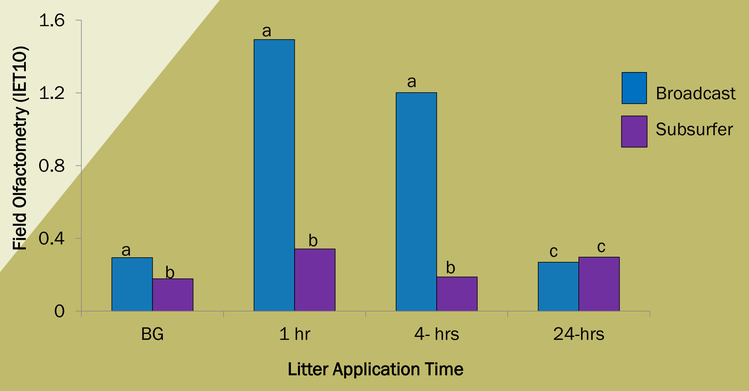
CORN YIELDS



Effect of poultry litter application methods on no-till corn yields. Bars with the different letters yields were significantly different (α ≤ 0.05).

The Subsurfer consistently increased corn yields when compared to all other treatments even when moisture levels were very low, which occurred in 2010. Subsurfer yields were significantly greater than disked in litter yields in 2008 and 2012 only. In 2009, 2011 and 2013, Subsurfer yields were significantly greater than the control only.

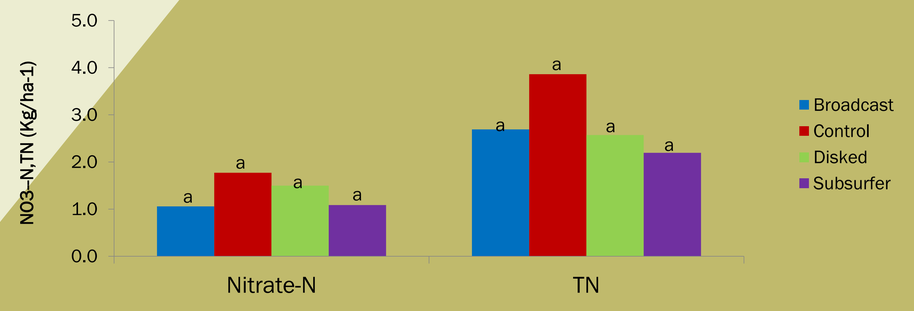
ODOR EMISSION RESULTS



Odor associated with broadcasting and subsurface turkey litter application. For each hour, bars with different letters were significantly different (α ≤ 0.05). Note: BG = Background.

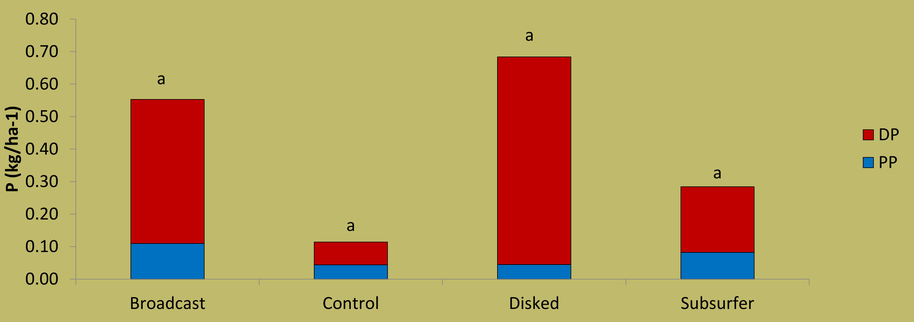
Significant differences in odor emissions were observed between broadcast and subsurface applied turkey litter at 1 and 4 hrs after application, but not after 24 hrs. Odor was reduced by as much as 92%.

P & N RUNOFF AND LEACHATE LOSSES



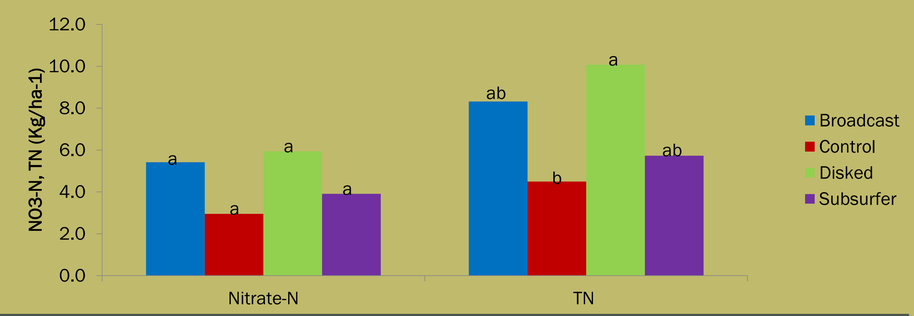
Seasonal mean cumulative NO_3-N and TN loss in runoff (2010-2012) * Values followed by the same letters were not significantly different (α ≤ 0.05) according to Tukey's mean separation.

No significant differences (α ≤ 0.05) were observed in NO_3-N losses over three years of monitoring N in surface runoff (N was not measured across the entire six years of runoff monitoring).



Seasonal cumulative mean total P losses in leachate (2008-2012). *Values followed by the same letters were not significantly different (α ≤ 0.05) according to Tukey's mean separation.

Also, there were no statistical differences observed in P leachate losses (α ≤ 0.05). The absence of significant differences reflects high variability in natural surface runoff. Elsewhere, highly controlled rainfall simulation studies that target periods around application have found significant differences between these kinds of application methods.



Seasonal mean cumulative N losses in leachate (2008-2012) *Values followed by different letters were significantly different (α ≤ 0.05) according to Tukey's mean separation.

For the most part, no differences were observed in N leaching between litter application treatments. However, disking in poultry litter did increase total N leaching losses relative to the un-amended control where TN losses were significantly higher for the disk treatment when compared to the un- amended control .

For additional information about this study, please contact Nancy Chepketer *(nchepketer@umes.edu)* or Dr. Arthur L. Allen *(alallen@umes.edu).*