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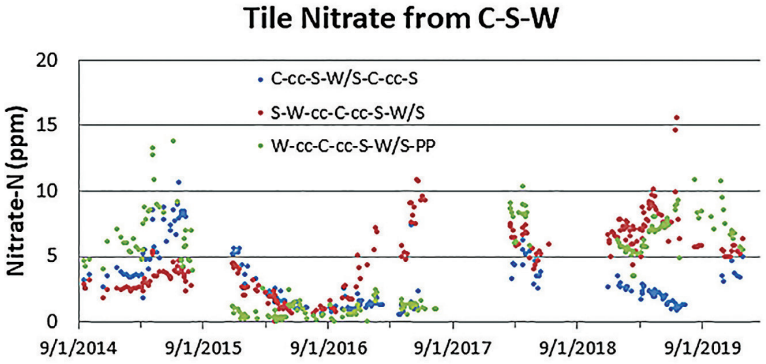
Investment Insight

Combining Cover Crops with a Woodchip Bioreactor for lower Nitrate Loss

Lowell Gentry, Dan Schaefer and Eric Miller are studying how installing a woodchip bioreactor at the edge of a field along with planting cover crops might limit nutrient loss. The tiled field they are using is located in central Illinois and also combines three crop rotation scenarios.

This study evaluates combinations of nutrient remediation techniques to create Best Management Practices BPM scenarios that when adopted regionally would make a significant reduction in the N and P export from agricultural runoff.

- Two remediation techniques that are often included in the various scenarios are 1) growing winter cover crops; and 2) constructing woodchip bioreactors on drainage tiles. This proactive research demonstrates the potential of maintaining high-yielding systems with minimal nutrient losses.
- **Tile nitrate losses are very low coming from Corn-Soybean-Wheat (C-S-W) rotation with cover crops**. It is clear that the longer rotation and the presence of cover crops limit nitrate losses as compared with the control treatment (corn-soybean). **Wheat in the rotation has a dramatic effect** on reducing tile nitrate loss as well as it takes up mineralized N following soybean.
- This shows that tile nitrate from **the Corn-Soybean-Wheat rotation with cereal rye after corn and double cropped soybean can achieve the proposed nutrient criteria for nitrate of 4 ppm** over the past 4 years. It is also worth noting that we didn't have to resort to growing only perennials (i.e. prairie plants or miscanthus) to accomplish this level of reduction in N loss. **This research documents the dramatic reduction in tile nitrate concentration and load that is possible under row crop agricultural production.**



Blue dots: Corn-cereal rye-Soybean-Wheat/Soy-Corn-cereal rye-Soybean
Red dots: Soybean-Wheat-red clover-Corn-cereal rye-Soybean-Wheat/Soy
Green dots: Wheat-turnip and radish-Corn-cereal rye-Soybean-Wheat/Soy-PP

Tile nitrate concentrations from C-S-W rotational systems from September 8, 2014 through December 31, 2019. In 2014, the entire study area was planted to winter wheat. Crop phases began in 2015.

- Woodchip bioreactor performance is below expectation, but **the combination of bioreactor and Drainage Water Management (DWM) at this site has reduced tile flow by approximately 40%,** and therefore, reduced tile nutrient load by the same percentage. It is possible that DWM has provided greater nutrient reduction than the bioreactors. It is also possible that DWM has limited tile flow during low flow periods, when the residence time would be sufficient for greater nitrate removal, decreasing bioreactor performance.
- This site produced an excellent double crop of soybean following wheat in the past three years (when double crop soy is planted before July 1), which has made this phase of the rotation the **most financially beneficial** (compared to corn or soybean alone). These results show a quick response time of tile nitrate to management and suggests long lag times are not an issue to improving tile water quality.

One of the most compelling pieces of information is that on the same soil type and under thesame weather conditions, **various agricultural production systems across this one farm can simultaneously transport tile water carrying as little as 1 ppm** (cereal rye after corn in W1), **or as high as 20 ppm** (fall N on corn in E2) as evidenced by tile water samples collected on June 24, 2019.

ILLINOIS NREC