Straw residue helps keep nitrogen on the farm

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This hairy vetch is establishing through small grain crop residues in April of 2008 in Rock Springs, Pa. Credit: Robert Gallagher, 2008.

Scientists are exploring ways to reduce non-point pollution from agriculture. A new study finds that using straw residue in conjunction with legume cover crops reduces leaching of nitrogen into waterways, but may lower economic return.

Agriculture is the largest source of nitrogen non-point pollution to waterways in the United States, flowing into streams and rivers via erosion from farmlands, or through leaching of nitrate into groundwater. Once in aquatic systems, excess nitrogen leads to aquatic ecosystem degradation, including oxygen depravation that leads to fish kills and dead zones. If nitrates leach into drinking water supplies, they are a

human health concern and have been linked to blue-baby syndrome, various cancers, and birth defects.

Legume cover crops, such as hairy vetch, have been considered as an alternative or supplement to synthetic nitrogen fertilizers that may improve the sustainability of agricultural systems. Such cover crops can contribute substantial amounts of nitrogen to subsequent crops, as well protect soils from erosion and promote overall soil quality. Legumes tend to release nitrogen more slowly than synthetic fertilizers, possibly being more synchronous with crop demand. That does not mean that nitrogen from legumes cannot be lost from the system.

One way to possibly minimize these losses may be to add more carbon to nitrogen-rich residues, such as those of cereal grain crops, during cover crop phase of the cropping systems. A research study conducted by Anna Starovoytov at Penn State evaluated the potential for straw residue to retain legume-derived nitrogen in a corn cropping system. Results from this study are reported in the May/June 2010 issue of the Agronomy Journal, a publication of the America Society of Agronomy. A portion of the research was also presented in New Orleans, LA at the 2007 International Annual Meetings for ASA, CSSA, SSSA on November 4-8, 2007.

The study revealed that adding straw residues to hairy vetch cover crops tended to lower soil inorganic nitrogen compared to treatments with strictly legume residues. On average, across sampling dates, soil inorganic nitrogen was 7.3% lower in the treatments with straw residue retention.

In this study, three different quantities of straw residue were spread on research plots that were later planted with to hairy vetch. A corn grain crop was later no-till planted into the vetch/straw residues. The type of residue present affected not only the magnitude of the peak of nitrogen

in soil but also the timing of this peak, which is important when considering the synchrony of nitrogen availability to corn nitrogen demand.

However, the reduced availability of nitrogen in the soil also negatively impacted corn grain yields, which in one year of the study fell 16% below the county average. The straw residue left of the field is often sold, contributing to the economic value of the overall grain crop. The study did not show that using the straw residue to help retain nitrogen would offset this loss of income from harvesting the straw.

The scientific study concluded that partial retention of small grain residues prior to a hairy vetch cover crop can reduce legume nitrogen losses, but may result in reduced crop yields in some years. Further research is needed to help better predict legume nitrogen availability and how to best integrate legume cover crops with synthetic fertility management systems.

More information: View the abstract at www.agronomy.org/files/publica … 09-0402-abstract.pdf

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