The use of cover crops is on the rise in across the United States in spite of low commodity prices in recent years. For example, the 2017 Iowa Learning Farms Field Day Evaluation Report states that approximately 760,000 acres were planted with cover crops in 2017 in Iowa, which is a 22% increase in cover crop use over the previous year (https://bit.ly/2HybzMV). This increase is promising but falls short of the goal of planting cover crops on 12.5 million acres in the state that was called for in Iowa’s Nutrient Reduction Strategy (www.nutrientstrategy.iastate.edu).

One barrier to the use of cover crops may be the cost. While there are long-term ecological benefits, farmers are influenced by the dollars they are spending in the short term. If funds are limited, the cost of planting and managing a cover crop may be difficult to justify. However, if cover crops can come with a short-term, tangible payout, the potential to be harvested and sold, this could expand their use.

Winter rye (Secale cereale) has the potential to do double duty as a cover crop and a source of income. The seed is relatively inexpensive, plants survive the cold Midwestern winters, and it performs well as a cover crop. “Rather than using herbicide to kill rye before planting soybean, it could be harvested at anthesis and sold for animal feed or a bio-economy feedstock,” explains Doug Karlen, a soil scientist with the USDA-ARS and member of ASA, CSSA, and SSSA.

This would provide an immediate return on investment for farmers in addition to providing the ecosystem services of a cover crop.

To investigate the potential role for winter rye in the Corn Belt, researchers conducted a modeling study that was recently published in Agricultural & Environmental Letters (https://bit.ly/2J5TSKr). Instead of including new field data for model calibration and testing in the article, the team used data from an earlier publication and the Root Zone Water Quality Model (RZWQM) to model winter rye in a corn–rye–soybean rotation. They compared no cover crop to unharvested winter rye and harvested winter rye.
with the harvested winter rye simulations having a range of N fertilization rates (0–160 kg N ha\(^{-1}\)). The model simulated rye growth, N uptake, corn and soy yield, and drainage N loss. The researchers used the model output to do additional calculations of the potential revenue if rye was sold as a bioenergy feedstock. The potential energy created if rye was used as a biomass feedstock was also estimated.

The most notable finding may be that the simulated winter rye cover crop treatments reduced N loss, even when N fertilizer was applied to winter rye in the spring. The simulated unfertilized, unleaved winter rye cover crop reduced draining N loss by 44% compared with no cover crop. When the simulated winter rye cover crop was fertilized at a rate of 120 kg ha\(^{-1}\), there was a 54% reduction in N drainage loss compared with no cover crop, and N drainage loss was 18% less than the non-harvested, non-fertilized rye.

Using winter rye as a harvested cover crop did not interfere with the corn–soy rotation. However, the results of the model suggest the addition of winter rye into the system may affect crop yields. The modeled scenarios found a less than 1% reduction in corn yield and a 4% reduction in soy yield when a winter rye cover crop was grown and soybean was planted in early June compared with the no cover crop system where soybean was planted in mid-May. The modeled scenarios found a less than 1% reduction in corn yield and a 7% reduction in soybean yield when winter rye was grown as a cover crop compared with the no cover crop system.

Currently, the only market for winter rye is as silage. Estimating that 90% of the winter rye biomass could be sold, the authors calculated the average annual revenue to range from $276 ha\(^{-1}\) with no N input to $468 ha\(^{-1}\) when N fertilizer was applied at a rate of 140 kg N ha\(^{-1}\).

The model suggests that harvesting winter rye can meet the goals of providing an additional source of income from harvesting and reducing N drainage loss. Although there is currently no market for winter rye as a bioenergy feedstock, this may become an option in the future. Finally, by using a modeling approach, the research team now has information that is being used to select treatments for new field studies being initiated as additional work on this topic.