Farmers use “green manure” to protect soil, fix nitrogen, and scavenge nutrients when cash crops are not present. These cover crops can also reduce weeds and act as a mulch for cash crops in no-till systems. Because of the increasing use of cover crops in no-till systems, researchers at Penn State recently compared two green manure cover crops, red clover (Trifolium pratense L.) and hairy vetch (Vicia villosa Roth).

“One of the reasons that we compared these was that farmers have started interseeding red clover,” says ASA member Heather Karsten, Associate Professor of Crop Production/Ecology. Interseeding, she explains, is also called relay cropping where farmers frost seed or drill red clover into a small grain very early in the spring.

Karsten is a co-author on a study recently published in *Agronomy Journal*, titled “Green Manure Comparison between Winter Wheat and Corn: Weeds, Yields, and Economics.” The authors report that red clover treatments were more profitable than hairy vetch due to increased cash crop yield and reduced herbicide application.

Dr. William Curran, Weed Extension Specialist and ASA member, had done prior research using hairy vetch in organic farming systems. As a co-author on this paper, Curran says, “I went into this thinking hairy vetch would be the winner . . . the results of this study surprised me a little bit.”

The experiment was conducted at the Russell E. Larson Agricultural Research Station in Pennsylvania. From 2010 to 2013, green manures were used in a winter cereal–green manure–corn silage rotation. As Karsten mentioned, the red clover treatment
was interseeded into the cereal grain crop whereas the hairy vetch, which was combined with triticale, was planted after the wheat harvest. Red clover was harvested for hay in late fall before corn was planted the following spring, and both cover crop treatments were terminated with herbicide in spring prior to corn planting.

Corn yields were consistently greater in red clover treatments. The difference was significant in 2012 and 2013 when corn yields were 16 and 9% greater, respectively, in red clover treatments compared with hairy vetch. “We don’t have all the explanations for why,” admits Karsten, but she says in 2012 and 2013, corn populations were significantly higher after red clover, and corn pest populations appear to be the culprits although there may also have been more nitrogen available from clover.

There was little difference in weed control, measured as weed biomass, between the two green manure treatments. However, red clover required fewer herbicide applications in the spring, amounting to a 28% reduction in herbicide active ingredient use. “Anytime you can use less herbicide, it’s an advantage,” says Curran, both economically by reducing costs, and ecologically by reducing selection for herbicide-resistant weed biotypes.

The economic benefits of increased yield, reduced herbicide, and harvesting red clover as forage were calculated as $1,355/ha more in net returns compared with hairy vetch. Even without the harvest of red clover for forage, the red clover treatments would have $123/ha greater profit than hairy vetch.

The results of this study may lead more farmers, agronomic consultants, and educators to consider the use of red clover as a green manure. “I know of conventional and organic dairy and grain farmers in Pennsylvania and New York who relay crop red clover into wheat before corn,” Karsten says. “And now, we have multiple reasons to recommend red clover over hairy vetch to more growers.”

Although red clover was the higher-performing green manure in this system, the authors point out that there are some limitations. Karsten explains that if wheat fields have high weed pressure, “then this interseeding might not be the best practice, but if weed populations are manageable and the typical sequence does involve rotating to corn, then we think this is a good strategy.”

Cover crops are not a cure-all and need to be used strategically. Before starting to use green manure, Curran advises farmers to “really think through the process,” meaning that farmers should take into account what benefits they hope to gain from using a green manure and how they will manage both the green manure and cash crops throughout the growing season.

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**Dig Deeper**

View the open access *Agronomy Journal* article, “Green Manure Comparison between Winter Wheat and Corn: Weeds, Yields, and Economics,” online at dx.doi.org/doi:10.2134/agronj2016.02.0084

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**In the next issue of CSA News...**

**Nitrous Oxide Emissions from Agriculture**

Nitrous oxide (N\textsubscript{2}O) is a potent greenhouse gas that has increased in the atmosphere due to human actions. One source of N\textsubscript{2}O emissions is agriculture, where denitrification of fertilizer and animal waste in fields and pastures can contribute elevated levels of N\textsubscript{2}O to the atmosphere. Recent research in SSAAJ and JEQ investigates the relationship between soil oxygen and N\textsubscript{2}O emissions, potential trade-offs between N\textsubscript{2}O emissions and nitrate (NO\textsubscript{3})\textsubscript{-} leaching, and impacts of management decisions, including the timing of manure application and use of cover crops, on N\textsubscript{2}O emissions. Having a better understanding of factors that impact N\textsubscript{2}O emissions will aid in the development of mitigation strategies to reduce emissions.

**FEATURING**

Andrew VanderZaag, Agriculture and Agri-food Canada

Xiying Hao, Agriculture and Agri-food Canada

Jen Owens, Lincoln University, New Zealand

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**Novel and Ancient Grains**

Agricultural production in the U.S. is dominated by corn, soy, and wheat. There is a growing interest in what would be considered “specialty” crops like quinoa, farro, and millet. What are the benefits and limitations of growing and selling these crops?

**FEATURING**

Dipak Santra, University of Nebraska-Lincoln

Abdullah Jaradat, USDA-ARS