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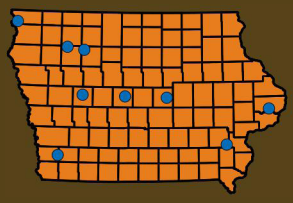
# Field Crops Research



# Cover Crop Variety Trial 2012-2013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- **Jerry Depew– Laurens**
- **Jeremy Gustafson – Boone**
- **Stephanie Hyde – Marshalltown**
- **Paul Kassel & Morgan McCarty – Linn Grove**
- **Greg King – DeWitt**
- **Steve McGrew – Emerson**
- **Michael Fields Ag Institute – East Troy, WI**
- **Myron Rees – Crawfordsville**
- **Mike VerSteeg – Inwood**


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http://bit.ly/pfi_fieldcrops

## In a Nutshell

- Over 100,000 acres of cover crops were planted in the fall of 2012.
- Cover crops protect soil from wind and water erosion and capture nitrogen that can otherwise leach from the soil.
- Nine cooperators from Iowa and one cooperator in central Wisconsin participated in this variety trial.
- Farmers collected ground cover data in the fall and spring for each plot using a cover crop measurement kit developed by PFI staff.
- Winter small grains had the greatest percent fall and spring coverage of all types following corn or soybean.
- Three legume species showed promise as overseeded species, providing fall coverage comparable to the winter small grains.

Project Timeline:
August 2012 - May 2013

***Cover crops - clockwise from upper left: Hairy Vetch, Oats and Winter Pea, Lentil, and Common Vetch***

## Background

### The Demand

Nearly 100,000 acres of cover crops were planted in the fall of 2012 according to seed sales from major cover crop seed companies (Burns communication, 2012; Ehrhardt communication, 2012) plus the acres cost-shared through the federal government's NRCS Environmental Quality Incentives Program and the state's IDALS State Cost Share fund. In 2013 it increased to 300,000 acres. In addition, many farmers who didn't take advantage of cost share funds continued to add cover crops to their farming system. A large majority of these acres were seeded with airplanes or helicopters. It can also be difficult to establish cover crops following corn or soybean harvest due to limited time available during the busy harvest and decreasing growing degree days that late in the year. Aerial seeding offers an earlier planting date than drilling and can be outsourced easily to service providers. However establishment with the aerial method may not be as uniform as drilling and sometimes farmers report not all cover crops germinate. In addition to rainfall effect on seed germination lack of properly screened cover crop species for Iowa's agricultural system could also reduce success.

### The Science

Cover crops protect soil from wind and water erosion and capture nitrogen that can otherwise leach from the soil and pollute nearby water sources. According to the Nutrient Reduction Strategy Science Assessment, cover crops on average can reduce nitrogen loading by 28% and phosphorus loading by 50% (Iowa Department of Agriculture and Land Stewardship et al., 2012). However, a winter small grain cover crop, although immensely beneficial to soil and nutrient protection, can have a negative impact on corn yields (Carlson, 2012). In 2010, six locations measured an average 12 bu/a reduction in corn yield following a winter rye cover crop; however no reductions were observed in 2009, 2011 and 2012. A threat to cash crop yield can discourage farmers from adding this conservation practice to their farms. Legume cover crops, which fix nitrogen and provide

a more plant favorable carbon/nitrogen ratio have not been evaluated extensively in Iowa when overseeded into standing cash crops. Establishment success of legume or grass-legume mix cover crops over-seeding into cash crops is lacking for Iowa.

This study screened 20 cover crop entries – some grasses, some legumes and some in a mixture – to determine which entries would have the greatest success if established by aerial seeding into standing crops.

## Method

Nine cooperators in Iowa and one in Wisconsin seeded 20 cover crop varieties in the fall of 2012 (**Table 1**). Cover crops were hand-seeded into a cash crop in two randomized, replicated blocks. Six farmers planted into standing soybeans, two into standing corn, one into both corn and soybeans, and two following short-season horticulture crops. Legume seeds were inoculated prior to seeding. Each plot was 7.5 ft wide and about 25 ft long.

### Seed Source

Cover crop seeds were supplied by: Timeless Natural Foods, Green Cover Seeds, USDA-ARS, Handcock Seed Company, Seed Land, Paramount Seed Farms and Albert Lea Seedhouse. Nine legumes, eight grasses, and three grass-legume mixtures were evaluated (**Table 2**).

### Planting Date

Cover crops were planted when the first soybean leaves yellowed, when corn reached black layer (physiological maturity), or when the short-season crops had

**Table 1**

**Cooperators for 20 Cover Crop Variety Trial**

| Cooperator | Location | Farming System | Cash Crop | Planting date | Fall measurement date | Spring measurement date | Spring biomass sample date |
|---|---|---|---|---|---|---|---|
| Art Behrens | Carroll | Organic row crop | Corn, Soybean | 9/9/2012 | 11/16/2012 | N/A | 4/30/2013 |
| Jerry Depew | Laurens | Conventional row crop | Corn | 8/28/2012 | 11/19/2012 | 4/28/2013 | 5/8/2013 |
| Jeremy Gustafson | Boone | Conventional row crop | Soybean | 9/4/2012 | 11/13/2012 | 4/5/2013 | 4/26/2013 |
| Stephanie Hyde | Marshalltown | Horticulture | Hort crop | 9/23/2012 | 12/18/2012 | 5/4/2013 | N/A |
| Paul Kassel & Morgan McCarty | Linn Grove | Conventional row crop | Soybean | 8/31/2012 | 11/20/2012 | 4/30/2013 | 5/6/2013 |
| Greg King | DeWitt | Horticulture | Hort crop | 9/12/2012 | 12/6/2012 | 4/24/2013 | N/A |
| Steve McGrew | Emerson | Conventional row crop | Soybean | 9/15/2012 | N/A | N/A | 4/29/2013 |
| Michael Fields Ag Institute | East Troy, WI | Biodynamic row crop & horticulture | Soybean | 8/28/2012 | 11/29/2012 | 4/4/2013 | 5/6/2013 |
| Myron Rees | Crawfordsville | Conventional row crop | Soybean | 9/20/2012 | 12/3/2012 | 4/5/2013 | 5/1/2013 |
| Mike VerSteeg | Inwood | Conventional row crop | Soybean | 9/11/2012 | 11/29/2012 | 5/6/2013 | 5/6/2013 |

**Table 2**

**Cover crop varieties and seeding rate (lb/A)**

| Legume | Grass | Mix |
|---|---|---|
| Lentil (50) | Winter Triticale-NE426GT (110) | Oats (62.5)/Legume Mix (7.5) |
| Legume Mix (15) | Winter Triticale-Trical 815 (110) | Oats (62.5)/Winter Pea (15) |
| Hairy Vetch (32.5) | Winter Triticale-VNS (110) | Oats (62.5)/Crimson Clover (13) |
| Common Vetch (62.5) | Winter Barley-Tambar 501 (102.5) | |
| Alfalfa (16) | Winter Barley-Pennbar 66 (102.5) | |
| Winter Pea (30) | Winter Barley-P954 (102.5) | |
| Deer Vetch (15) | Winter Barley-P919 (102.5) | |
| Sunn Hemp (40) | Cereal Rye (125) | |
| Crimson Clover (26) | | |

been harvested and removed. Seeds were not incorporated into the soil even in the short-season fields. Cash crops were harvested using standard practices, and the cover crops were left undisturbed.

### Data Collection

Farmers determined ground cover of each cover crop using a measurement kit developed by PFI staff. A pre-marked 16-ft rope was placed diagonally across one cover crop entry's plot, and farmers counted how many marks lay on top of cover crop biomass at 6-in. increments. These counts were used to calculate the percent coverage of the soil by the cover crop. A fall measurement was taken within a few days of the first predicted snowfall, and a spring measurement was taken between early April and early May, depending on snowmelt. Where sufficient growth had occurred, samples of the aboveground cover crop biomass were collected in the spring, weighed to determine total biomass, and submitted to Iowa State University for lab analysis of carbon and nitrogen concentration. Neither fall nor spring measurements were taken at the McGrew farm due to lack of rainfall, and spring measurements could not be taken at the Behrens farm.

### Statistical Analysis

Where possible, data were analyzed using SAS, employing a mixed model with cooperator, cover crop variety, cover crop class (grass, legume, or mix), replication, and previous cash crop as variables. Values reported are least-squares means where statistical analysis was performed, and differences are considered significant at the $P \leq 0.05$ level. Where applicable, least significant difference (LSD) is provided as well.

## Results

### Vegetative Cover

Both fall and spring coverage differed among cooperators (**Figure 1**). For fall coverage, bars with different lower-case letters above them are different (LSD = 16.3). For spring coverage, bars with different upper-case letters above them are different (LSD = 12.2). Across farms, cover crops sown into standing soybeans had an average of 31.8% coverage in the fall, compared to 22.6% for corn and 14% for a horticultural crop (**Figure 1**). At the Behrens farm only, cover crops were planted into both standing corn and standing soybeans. Fall coverage did not differ between cover crops sown into corn or soybean at the Behrens farm (**Figure 1**). At all farms, spring coverage was less than fall coverage.

The grass species tended to provide more fall and spring cover than legumes and mixes (**Figure 2**). For fall coverage, bars with different lower-case letters above them are different (LSD = 24.5). For spring coverage, bars with different upper-case letters above them are different (LSD = 18.0). The coverage in spring (as a percent of fall coverage) was greater for grasses (58.6%) than for legumes (24.1%) or mixes (22.6%). Some species, such as oats, are not cold-tolerant and will winterkill. Cereal rye, which experienced the lowest drop-off (5%) in soil coverage from fall to spring among the entries evaluated, is winter-hardy and can continue growing in the spring. Triticale proved to be as winter-hardy as cereal rye statistically, while barley proved to be less winter-hardy than cereal rye (**Figure 2**). Many of the legumes and mixes only retained approximately 25% of fall growth.

**Figure 1**

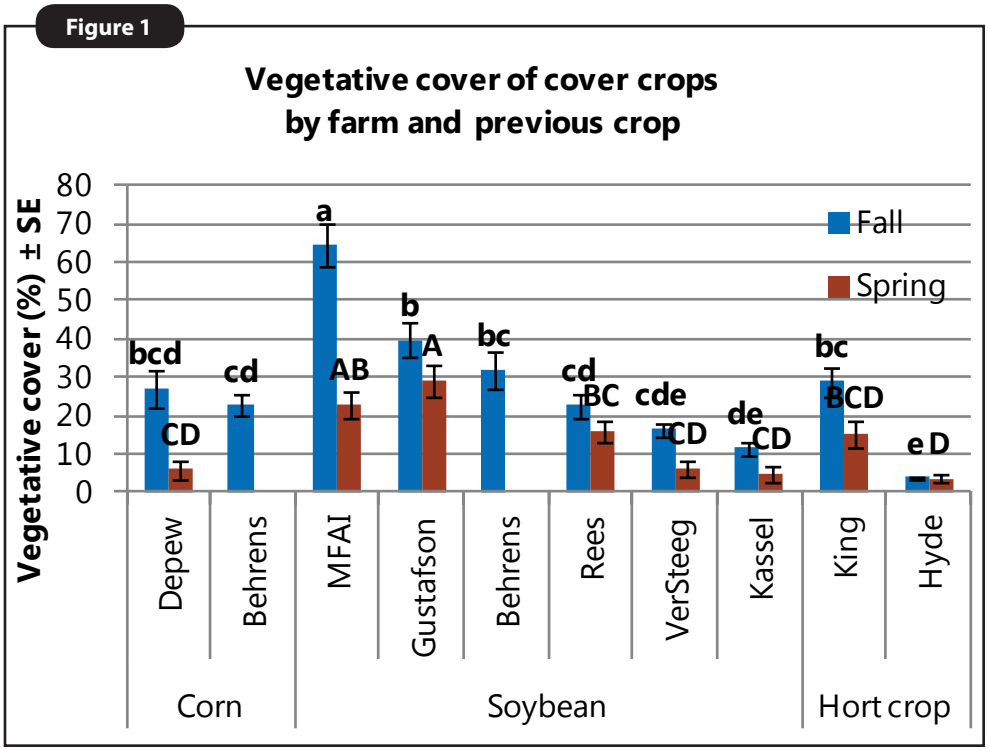
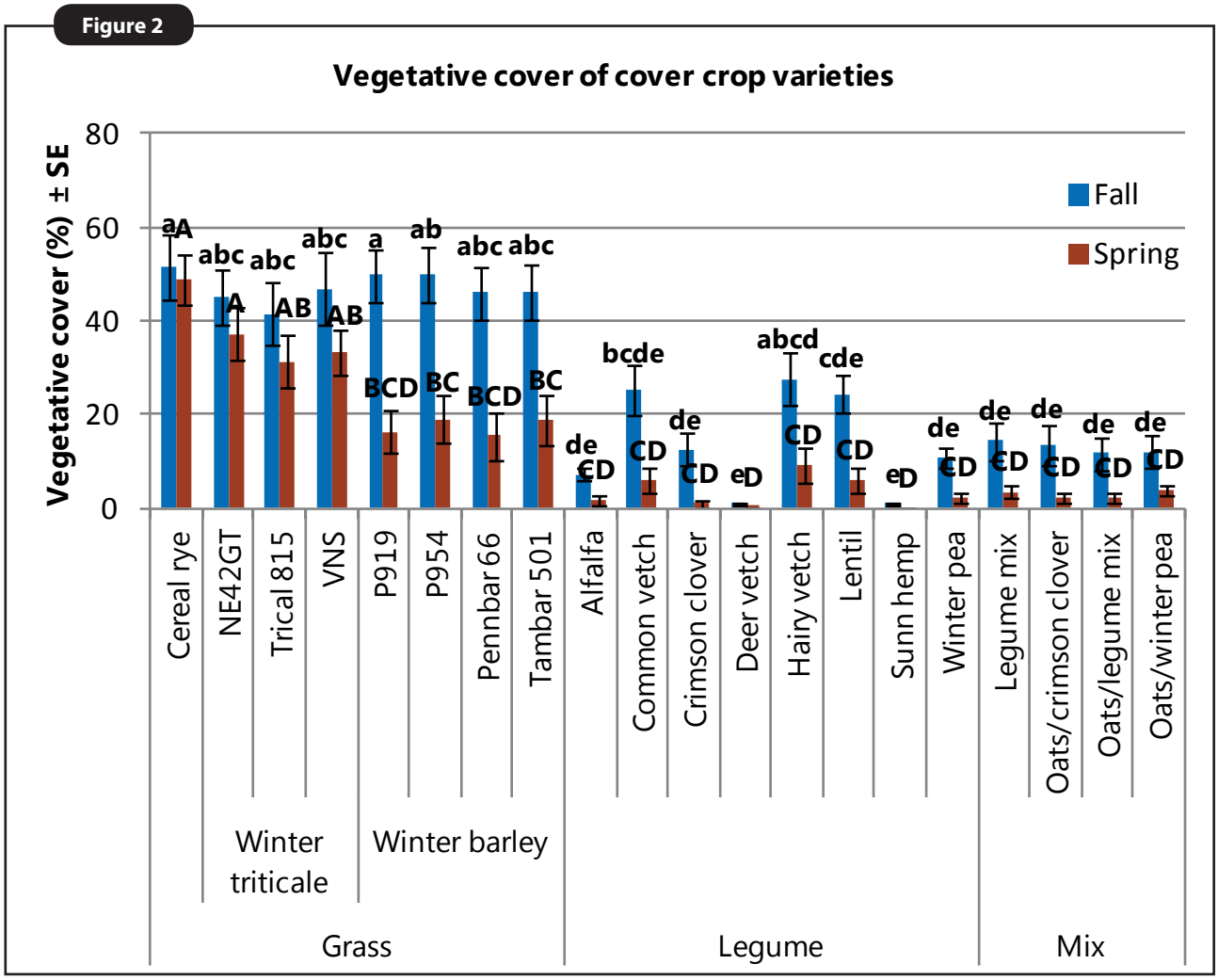


Figure 2




**Spring Biomass**

Spring cover crop biomass differed among cooperators (LSD = 152; **Figure 3**) and entries (LSD = 241; **Figure 4**). Across entries, cover crop biomass tended to be greatest when planting into a previous soybean crop (Fig. 3). On average, spring biomass was 125.8 lb/a where cover crops were sown into soybean, but only 50.1 lb/a where cover crops were sown into corn. The greatest biomass resulted from cereal rye, at over 600 lb/a, followed by winter triticale varieties, and then barley varieties and hairy vetch (Fig. 4). Several legume species did not have sufficient biomass to enable sampling. It appeared that no legume or mix survived through the winter when sown into corn fields (data not shown).

**Total Carbon and Nitrogen**

When possible, spring cover crop biomass samples were sent for laboratory analysis of carbon and nitrogen concentration. Carbon/nitrogen ratios of select cover crops are provided in **Figure 5**. Lack of a complete, balanced sampling of spring biomass for C and N concentration prevented any accurate statistical analysis in this case. Standard error bars are provided in cases when more than one replicate of a cover crop was submitted for analysis (**Figure 5**). It does not appear that much difference in C/N ratio existed among the cover crops analyzed. Legumes would be expected to have more nitrogen than grasses (and thus a lower C/N), but because so little growth was observed in the legumes, it is possible that nitrogen fixation had not begun yet. Also grasses were still in a very vegetative state and also still at a low C/N ratio. As a grass cover crop grows its C/N ratio rapidly increases.

Figure 3

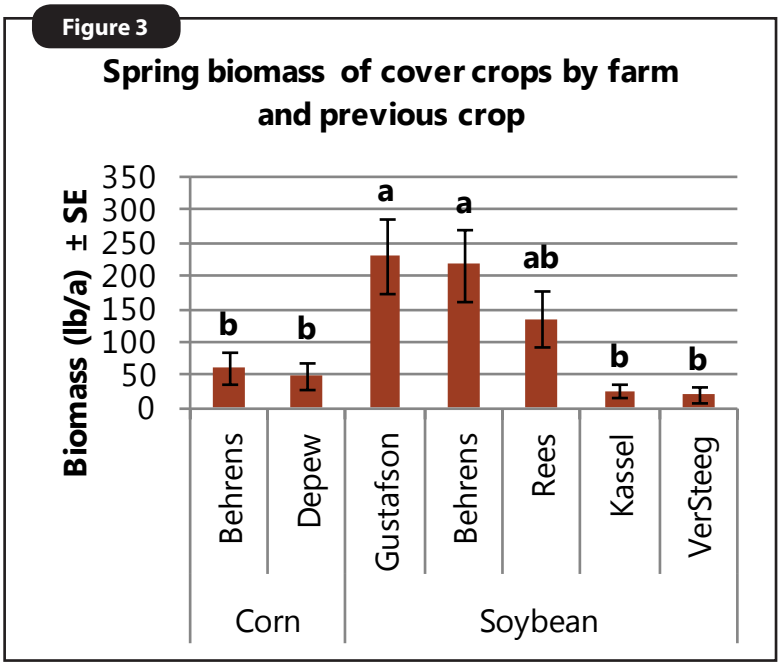
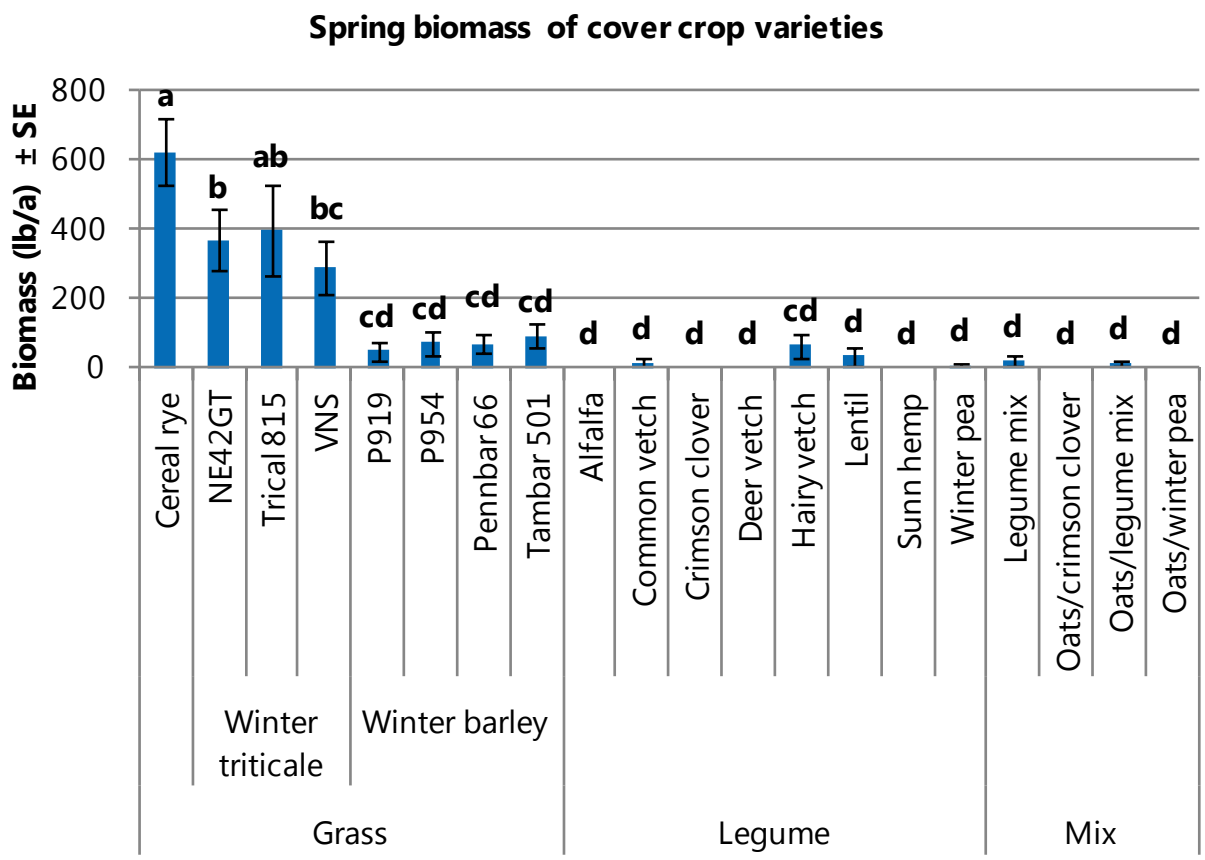


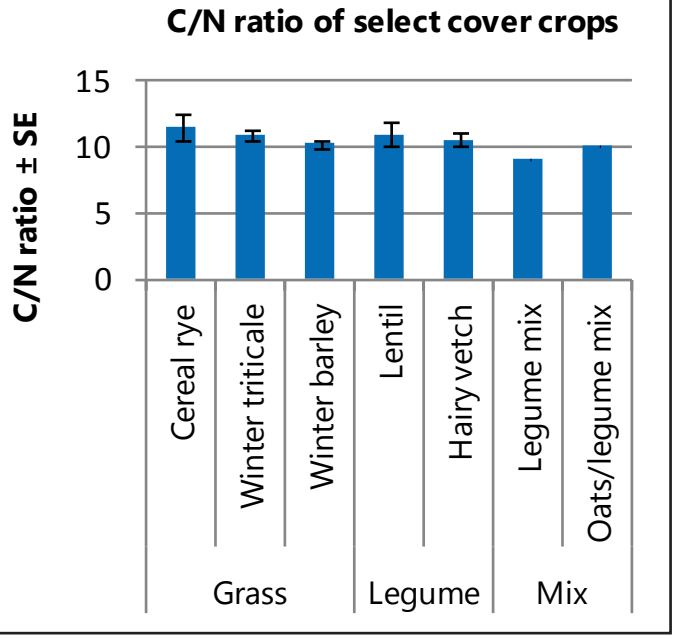
Figure 4




## Conclusions and Next Steps

Winter small grains, particularly cereal rye, continue to provide the greatest coverage in the fall and spring and the most spring biomass, of all tested cover crop entries. However, some legumes – particularly vetches and lentil – produced around 25% fall coverage. Cover crops seem to establish better in soybean fields than cornfields; this may be due to better sunlight penetration through the canopy when soybeans drop leaves, compared to tall corn plants. Over several years, these differences and effects may become clearer. Ultimately, the "best" cover crop varies with each farm's goals. Those looking for lots of coverage and biomass may want to consider cereal rye. Those wishing to avoid the potential risks associated with rye might want to try it in a mix with legumes or brassicas. Farmers hoping to graze livestock may choose one of the winter-hardy small grains for maximum feed quantity, or add a hardy legume to the mix for additional feed quality. For all of these goals, Iowa-tested cover crop varieties will continue to improve farmer success.

Figure 5



Cereal rye cover crop seeded into standing soybeans at Jeremy Gustafson's farm

## References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## PFI Cooperators Program

PFI's Cooperators' Program gives farmers practical answers to questions they have about on-farm challenges through research, record-keeping, and demonstration projects. The Cooperators' Program began in 1987 with farmers looking to save money through more judicious use of inputs.