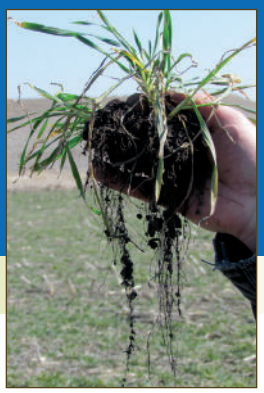
# Winter Cereal Rye Cover Crop Effect on Soil



Iowa Learning Farms and Practical Farmers of Iowa

Year 7


## Summary

**While there were differences among locations, there were generally no differences in soil health variables between the no-cover and cover crop treatments at individual locations.**


## Cooperators

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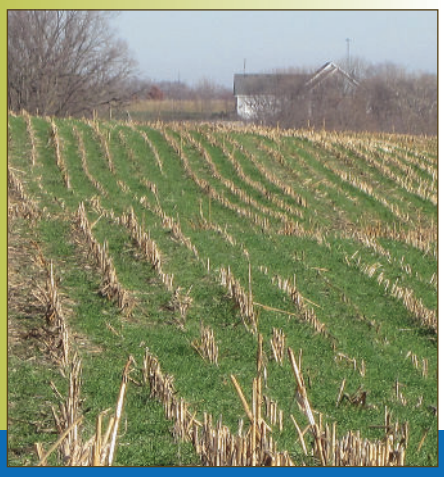
Rick Juchems, Plainfield
Rob Davis & Darwin Pierce,
Whiterock Conservancy, Coon Rapids
George Schaefer, Kalona
Jerry Sindt, Holstein
Rob Stout, West Chester
Kelly Tobin, New Market

## Project Timeline

2008-2015


This project was funded by the State Soil Conservation Committee and the Iowa Department of Agriculture and Land Stewardship. Additional outreach andeducation funding came from a NCRSARE grant, Walton Family Foundation and the Iowa Learning Farms.

## Methods

- Three locations began in Fall '08 (Jefferson, Plainfield, Coon Rapids); four locations were added in Fall '09 (Kalona, West Chester, Holstein, New Market).
- All locations are in corn-soybean rotations
- Cooperators established and maintained 3 to 4 field length replicated strips. Each replication had one strip with cover crops and one without.
- Cooperators seeded a cereal rye cover crop in the fall (aerially or drilled) with seeding rates between 50-112 lb/ac. Termination was primarily accomplished with herbicide beore cash crop planting the following spring.
- June 2015 - Soil samples to a depth of six inches were collected and sent to Ward Laboratories in Kearney, Neb. using the Haney Test analysis for the soil health indicators listed below:
    - o Organic matter
    - o Water extracted total organic C
    - o Water extracted organic N
    - o Nitrate concentration
    - o Soil microbial activity (Solvita $CO_2$-C burst)
    - o Soil Health Calculation

## Results

### Soil organic matter, total organic C and organic N

Organic matter and total organic C were not affected by the cover crop at any of the locations. Detectable changes in soil C fractions can take many years as shown by studies in Iowa (Kaspar et al., 2006) and Maryland (Steele et al., 2012) that were also unable to detect changes in organic C after three years and 12 years, respectively. Organic N was also not affected by the cover crop except for one location (Jefferson) where the no-cover treatment actually resulted in slightly greater organic N (Table 1).

### Soil nitrate concentration

Nitrate concentrations in the soil were mostly not affected by the cover crop; except Kalona where there was a greater nitrate concentration in cover crop treatments. These results show that the cover crop is not tying up plant-available N (nitrate) at a critical point in cash crop development (mid-June).

### Soil microbial activity (Solvita $CO_2$-C burst)

The Solvita burst is used in the Haney Test to measure soil microbial respiration. This can be considered a proxy for soil microbial activity. There was no effect of cover crop on the Solvita burst at any of the sites (Table 1).

## Soil health calculation

The Soil Health Calculation determined by the Haney Test did not differ between the treatments at any of the location sites. The Soil Health Calculation considers soil microbial activity as well as soil C and N concentrations (the higher the score, the better). As there were generally no differences in soil C and N concentrations or soil microbial activity due to the cover crop, the Soil Health Calculation was unaffected (Table 1).

**Soil Health Calculation =**
**(Solvita burst ÷ organic C:N)**
**+ (organic C% ÷ 100)**
**+ (organic N% ÷ 10)**

Ward Laboratories (2016)

**Table 1. Soil health indicators assessed by the Haney Test at locations in June 2015.**

| Location Treatment | Organic matter (%) | Total organic C (%) | Organic N (%) | Nitrate conc. ($NO_3$-N ppm) | Solvita $CO_2$-C burst (ppm) | Soil Health Calculation |
|---|---|---|---|---|---|---|
| Jefferson, June 16 (n=4) | | | | | | |
| No-cover | 4.45 | 2.26 | 0.20 | 13.6 | 72 | 11 |
| Cover | 4.55 | 2.21 | 0.19 | 10.8 | 85 | 11 |
| P-value | 0.9092 | 0.6103 | 0.0330 | 0.4072 | 0.7357 | 0.8578 |
| Juchems, June 18 (n=3) | | | | | | |
| No-cover | 4.27 | 2.47 | 0.22 | 9.7 | 122 | 15 |
| Cover | 4.43 | 2.34 | 0.21 | 8.9 | 140 | 17 |
| P-value | 0.6940 | 0.2532 | 0.1074 | 0.6418 | 0.1125 | 0.1485 |
| Coon Rapids, June 16 (n = 3) | | | | | | |
| No-cover | 6.30 | 3.14 | 0.28 | 9.2 | 125 | 17 |
| Cover | 6.67 | 3.36 | 0.28 | 9.4 | 100 | 14 |
| P-value | 0.4652 | 0.3628 | 0.9880 | 0.7745 | 0.4253 | 0.3466 |
| Kalona, June 17 (n = 3) | | | | | | |
| No-cover | 2.73 | 1.59 | 0.14 | 4.8 | 56 | 8 |
| Cover | 2.63 | 1.58 | 0.14 | 5.9 | 61 | 9 |
| P-value | 0.7952 | 0.8440 | 0.8556 | 0.0277 | 0.8814 | 0.8735 |
| West Chester, June 17 (n = 3) | | | | | | |
| No-cover | 5.27 | 2.95 | 0.25 | 15.8 | 133 | 17 |
| Cover | 5.57 | 2.78 | 0.23 | 11.9 | 156 | 18 |
| P-value | 0.5460 | 0.3222 | 0.4829 | 0.2037 | 0.4306 | 0.6189 |
| Holstein, June 23 (n = 4) | | | | | | |
| No-cover | 4.10 | 2.08 | 0.18 | 15.5 | 129 | 15 |
| Cover | 4.18 | 2.24 | 0.19 | 15.4 | 133 | 16 |
| P-value | 0.8160 | 0.3550 | 0.5542 | 0.9708 | 0.7901 | 0.8344 |
| New Market, June 22 (n = 4) | | | | | | |
| No-cover | 4.40 | 2.23 | 0.19 | 6.6 | 122 | 15 |
| Cover | 4.20 | 2.18 | 0.19 | 6.8 | 100 | 15 |
| P-value | 0.2952 | 0.6325 | 0.8103 | 0.9226 | 0.6415 | 0.4888 |

If P-Value is less than 0.05, there is strong evidence that the two treatments (cover and no-cover) are different. If P-value is larger than 0.05 there is no treatment effect on the measurement.

## Conclusions

There were generally no differences in soil health variables between the no-cover and cover treatments at the locations. However, farmers and researchers have shown for years that a cover crop can reduce soil erosion and prevent nutrients from leaching into surface waters. Moreover, after seven years of this study, farmers have reported no effect of the cover crop on corn and soybean yield in the majority of the locations. For more see "Winter Cereal Rye Cover Crop Effect on Cash Crop Yield: Year 7" (2016).

## Resources


Gailans, S. and L. Juchems. 2016. Winter cereal rye cover crop effect on cash crop yield, Year 7 update. Practical Farmers of Iowa Cooperators' Program and Iowa Learning Farms. Ames, IA. http://www.extension.iastate.edu/ilf/content/cover-crop-research

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Steele, M., F. Coale, and R. Hill. 2012. Winter annual cover crop impacts on no-till soil physical properties and organic matter. Soil Sc. Soc. Am. J. 76:2164-2173.

Ward Laboratories. 2016. Haney/Soil Health Test Information. Ward Laboratories, Inc. Kearney, NE. http://www.wardlab.com/haney/haney_info.aspx (accessed Apr. 22, 2016).



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