# PFI farmers add cover crops without sacrificing yield

*by Sarah Carlson*

***PFI farmers find no reduction in corn/soybean yields following cover crops in 2011 research. This is good news especially in light of alarming soil losses due to erosion in the state. Iowa's land has lost significant amounts of soil since annual crop farming began. Average erosion across the state is 5.2 tons/acre/year, with some areas losing significantly more. Cover crops protect the soil year-round, capture sunlight to grow plants that build soil and sequester excess nitrogen, which can stop soil and nutrient loss.***

A few of the benefits of cover crops include soil quality improvements by protecting soil from erosion, increasing soil microbial activity and cycling nutrients, decreasing excess nitrogen or adding to soil carbon.

Table 1

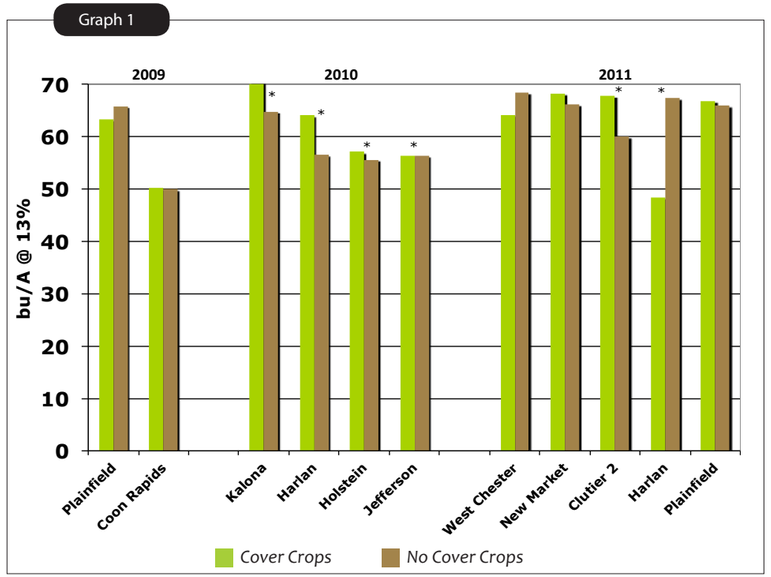
**Cash Crop and Cover Crop Management**

| Location | 2009 crop | 2010 crop | 2011 crop | 2010-2011 cover crop planting | 2011 cover crop termination |
|---|---|---|---|---|---|
| Harlan | Corn | Soybean & Corn | Corn & Soybean | Aerial | Herbicide |
| Jefferson | Corn | Soybeans | Corn | Drilled | Herbicide |
| Plainfield | Soybean | Corn Silage | Soybean | Drilled | Herbicide |
| Coon Rapids | Soybean | Corn | Soybean | Drilled | Herbicide |
| Clutier | - | Corn | Soybean | Drilled | Disked & Soil Finisher |
| Kalona | - | Soybean | Corn | Aerial | Herbicide |
| Holstein | - | Soybean | Corn | Aerial | Herbicide |
| Fort Dodge | - | Soybean* | Corn | Aerial | Herbicide |
| West Chester | - | Corn | Soybean | Aerial | Herbicide |
| New Market | - | Corn | Soybean | Drilled | Herbicide |

***Table 1.*** *Describes each location's cash crop and cover crop management.*

Conventional row-croppers, livestock producers, fruit and veggie growers and organic integrated crop and livestock farmers want to know more about cover crops and adding them to their current farming systems. Cover crops are normally planted without the intention of a direct harvest. Rather, they are planted for the multiple benefits they provide to the farmer and the environment. In Iowa, cover crops are usually planted into standing corn or soybean crops or are planted after grain harvest. However, difficulty may exist in planting cover crops during this time, a busy one for farmers. For corn and soybean farmers, adding a cover crop can be the first step towards adding a third crop or other diversity to the farming system. Because direct, immediate economic benefit is not necessarily derived from cover crops, farmers must make profit on their cash grain crop. Ensuring that a cover crop does not significantly impair the cash crop is necessary for widespread adoption.

Graph 1




** indicates significant differences using Student's t-test at an α=.05 level.*

To begin addressing those concerns PFI farmers launched one of several studies to get answers. Practical Farmers of Iowa and Iowa Learning Farms recruited 10 farmers across Iowa to establish cover crop and no cover crop strips for four to five years on their farms. These farmers planted a winter rye cover crop in the fall, terminated the cover crop the following spring and then planted either corn, corn silage or soybeans. Then in the fall farmers harvested their corn, corn silage or soybeans and measured the yield of those cash crops on both the former cover crop or no cover crop strips. Below is a table of the different locations of the farms and how the cover crop is planted (aerial or drilled); terminated (usually with herbicide) and which crop is planted in which year.

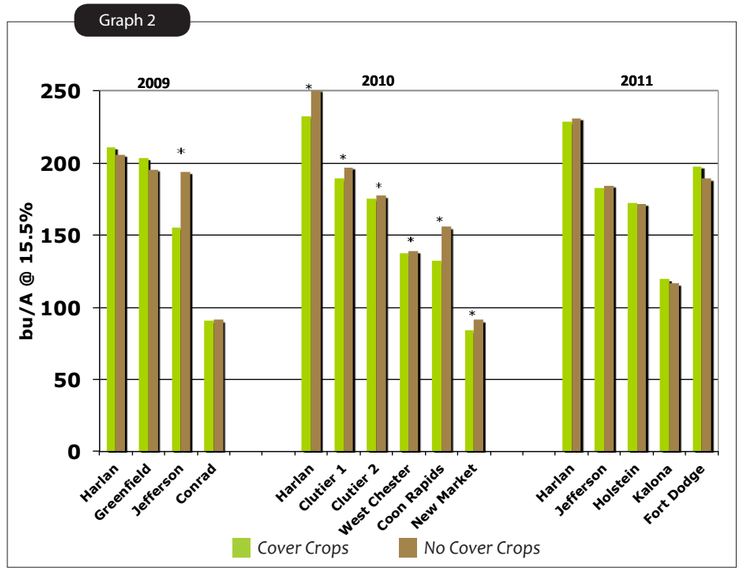
Before the study began soil cores at each location were taken to measure various soil quality indicators, including soil organic matter and steady state water infiltration rates. At the end of the five years Practical Farmers and Iowa Learning Farms staff will re-sample these areas to determine cover crop effect on soil quality and water infiltration.

After three years of this study all cash crop results are similar to results reported from the National Laboratory for Ag in the Environment (NLAE) and other published results.





Graph 2




** indicates significant differences using Student's t-test at an α=.05 level.*

## Corn Yield

In 2009 and 2011, corn yield was not statistically different when grown following a cover crop or no cover crop except at Jefferson in 2009, where failure to control the cover crop resulted in decreased corn yield following the cover crop. In 2010, corn yield following a cover crop was negatively impacted at all locations. This resulted in a decrease in corn yield of 12 bushels per acre when following a cover crop across all locations

## Soybean Yield

Soybean yield ranged from 49.9 bushels per acre in 2009 at Coon Rapids to 70.4 bushels per acre in 2010 at Kalona. In 2009 soybean yields were not statistically different between the two treatments. In 2010, soybean yield at all locations in the cover crop treatment was statistically higher than in the no cover crop treatment. This resulted in a yield "bump" of 4 bushels per acre in the soybean plots where cover crops had been planted in the fall of 2009. In 2011, no difference in soybean yield was measured at three of the five locations. Soybean yield was greatly reduced at Harlan, yielding 18 bushels per acre less where cover crops had been planted in the fall of 2010 to the spring of 2011. This was due to extreme flooding in a part of the field. Bill Buman, farmer at Harlan, said that "the cover crop wasn't the culprit for the reduced soybean yield. We were in the shadow of the Missouri River flooding and just stayed wet for too long. All our yields were affected. We don't feel the cover crop was the problem."

At Clutier soybeans yielded 8 bu/A higher following a cover crop than in the no cover crop strips. Yield data from Coon Rapids is not available for 2011 due to a technical issue.

## Corn Silage Yield

Corn silage yields were not different whether grown following a cover crop or not.

There was an average of 711 pounds per acre cover crop biomass that grew. This biomass helps capture excess nitrogen and will add to the long term soil carbon in the soils. Pounds of nitrogen in the aboveground biomass ranged from 7.3 pounds per acre to 47.3 pounds per acre, greater amounts of aboveground biomass result in greater amounts of nitrogen that is captured and stored in the plant material.

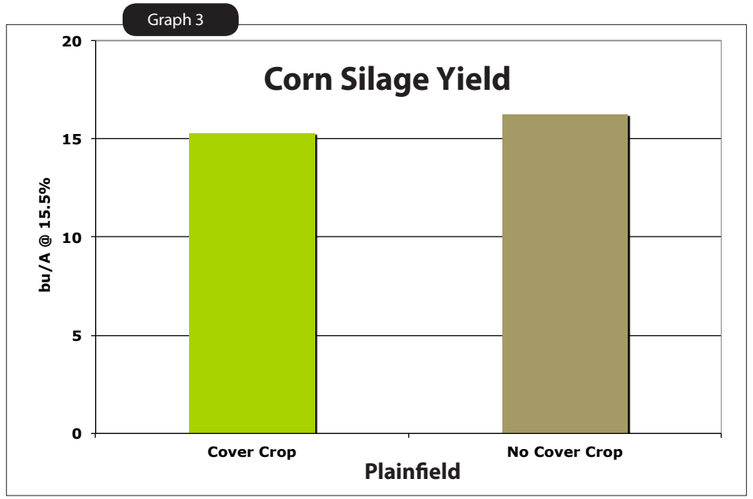
## Conclusions

Overall, a fall cover crop had no significant impact on the following cash crop's yield for corn in 2011; however, at one location soybeans were negatively affected due to other circumstances than the cover crop and at another location was positively affected when planted following a cover crop in 2011. Additional years of this trial will determine longer-term impact of using cover crops on cash crop yield.

For more on this research, see the report, "Winter rye cover crop effect on cash crop yield," at **http://tinyurl.com/CCcash2012**.

*Funding for this study was provided by Iowa Dept of Agriculture and Land Stewardship and the Walton Family Foundation. Special thanks to Dr. Tom Kaspar, Ben Knutson, National Laboratory for Agriculture and the Environment and Aaron Saeugling, Iowa State University.*

Graph 3



# PFI farmers test aphid-resistant soybeans

*by Sarah Carlson*

***The soybean aphid is a bane for Iowa soybean farmers. Since 2003, aphids have been detected in every county in Iowa, reducing soybean yields by feeding on the plant and transmitting plant diseases. In hopes of countering losses caused by this pest, in 2011, four PFI farmers—Mark Peterson, Chris Goedhart (Dordt College), Paul Mugge and Ron Rosmann—tested varieties of soybeans with natural resistance to aphids.***

At the Mugge, Rosmann and Dordt farms, aphid-resistant varieties had fewer aphids present during the height of the aphid season while yielding equal to or greater than susceptible soybeans. Only at Mark Peterson's farm did the susceptible soybean significantly outperform the aphid-resistant soybeans.

## Dealing with a "huge problem"

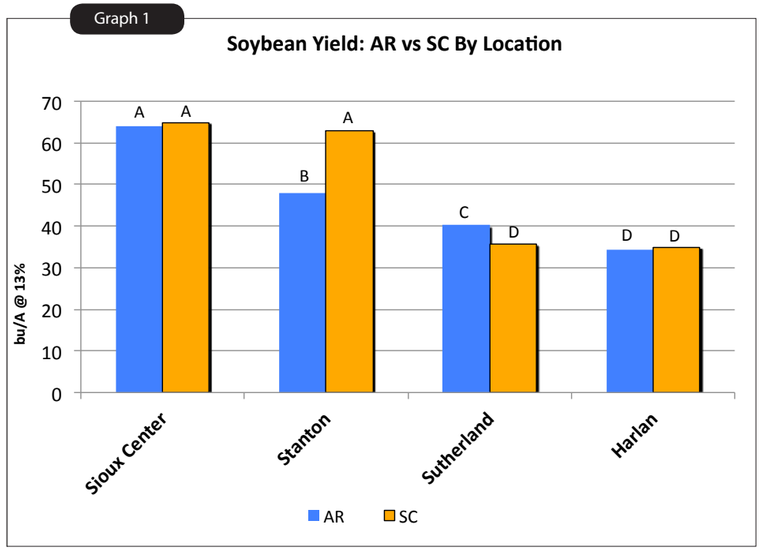
"Soybean aphids were a huge problem in 2007, 2008 and 2009, costing 15 to 20 bushels/acre yield loss," Paul Mugge says. "It is much preferable to deal with them genetically rather than chemically." Insecticides can damage natural enemy populations like lady beetles, which can greatly reduce aphid populations by feeding. And with decreased natural enemy populations, further aphid outbreaks can occur.

*PFI farmer Paul Mugge records data during an aphid-resistant soybean trial.*

Paul's system is organic, so he is limited to only a few commercial products (Neem oil, mineral oil, insecticidal soap and Pyrethrins) to help control the aphids with a bio-insecticide. According to Paul, the products' efficacy has been mixed at best. So Paul has been eager to try the aphid-resistant varieties screened by USDA and researchers at Iowa State University and the University of Illinois.

Paul planted both the aphid-resistant and susceptible soybeans on May 10 and harvested them October 5. He managed weeds with a multiple rotary hoe and cultivator passes and took two aphid counts: One count on August 6 found statistically more aphids on the susceptible variety (549 aphids per plant) compared to the aphid-resistant variety (103 aphids per plant). Another count taken on August 20 found no difference between varieties and resulting aphid populations. At Paul's farm, the aphid-resistant variety yielded significantly higher than the susceptible variety, 40.2 bushels per acres and 35.7 bushels per acre, respectively even under economically damaging aphid populations.

Graph 1




**Different letters indicate significant differences using Student's t-test at an α=.05 level*

## Fewer aphids, consistent yield with aphid-resistant soybeans

Ron Rosmann planted both types of soybeans on May 27 and then replanted the susceptible variety June 7 because of poor emergence. Like Paul, he also managed weeds with a multiple rotary hoe and cultivator passes. ISU researchers conducted aphid counts August 17 and aphid numbers were significantly less on the aphid-resistant variety (six aphids per plant) compared to 33 aphids per plant on the susceptible variety. In Ron's field, no significant differences in yield were measured between the two types of soybeans.

## Aphids skip the Peterson farm

A new PFI Cooperator, Mark Peterson, was motivated to participate in the study "to deter aphids without insecticide" and "better care of the environment." At Mark's farm, three types of varieties were compared:

*PFI farmer Ron Rosmann participates in the aphid-resistant soybean trial.*





1) aphid-resistant, glyphosate-tolerant, 2) aphid-resistant, conventional and 3) a susceptible, gylphosate-tolerant. Mark planted on May 7 and harvested October 1. Aphid-resistant and susceptible soybeans yielded similarly. The glyphosate-tolerant soybeans yielded 59.4 bushels per acre, statistically higher than the conventional variety of 51.5 bushels per acre. ISU researchers conducted the aphid counts on August 17-18, but no aphids were found at Mark's farm.

*PFI farmer Mark Peterson tested aphid-resistant soybeans.*

## Dordt's Chris Goedhart joins study and counts fewer aphids

Finally, at Dordt, the planting date was May 10 and harvest was September 28. Both soybean varieties at Dordt College were glyphosate-tolerant and glyphosate was used to control weeds. Dordt took aphid counts weekly between July 25 and August 29. No significant differences in yield were measured between the two varieties (average yield was 64.5 bushels per acre).

Dordt researchers applied the insecticide Endigo (at four ounces per acre) to half of the plots to test the performance of the different varieties with and without an insecticide application. Aphid-resistant soybeans without an insecticide treatment (63.9 bushels per acre) yielded similarly to susceptible soybeans that received an insecticide treatment (66.9 bushels per acre) **(Graph 2)**.

*PFI member Chris Goedhart of Dordt College participated in the soybean trial.*

## Lessons learned

Potential lessons from the 2011 data? In highly impacted areas or where a lack of aphid management options exists, it may be beneficial to plant resistant varieties as insurance against aphid damage in some years. In a farming system where insecticides are available to control aphids, an aphid-resistant variety might yield as well as a susceptible variety even when an insecticide is applied. The cost of an insecticide application from the 2011 ISU Farm Custom Rate Survey ranges from $4-$14 an acre plus the estimated cost of a full rate of AsanaR XL insecticide at $4.85 an acre for 2012. Additional charges for scouting soybeans would need to be attributed to the cost of managing the aphids in the susceptible soybean fields. Considering crop protection costs and yield and aphid pressure differences, an aphid-resistant variety might be a good insurance policy in both organic and conventional farming systems. More years of data with higher aphid populations will further confirm the expected performance of aphid-resistant soybeans.

## Want more information?

For more on this research, including methods used, see the research report, "Aphid-resistant versus susceptible soybean varieties," on the PFI website: www.practicalfarmers.org

*Funding for this study was provided by the Leopold Center for Sustainable Agriculture and the Iowa State University On-Farm Research Program. Special thank you's to Blue River Hybrids, Albert Lea Seedhouse, and Drs. Matt O'Neal and Walt Fehr at Iowa State University.*

Graph 2