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Cooperators

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Project Timeline

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Winter Rye Cover Crop Effect on Cash Crop Yields: Year 3

Written by Sarah Carlson and Amber Anderson

Abstract

Cover Crops are an important addition to any farming system to improve soil quality and decrease soil erosion or nutrient loss. Farmers are concerned that a winter rye cover crop could negatively impact their cash crop yields. Cover crop had no effect on corn yield at eight site-years, however it negatively impacted corn yield at six sites in 2010 and one site in 2009 where the cover crop was not properly managed. Cover crop either positively affected or did not affect soybean yield in 10 out of 11 site-years. At one location in 2011, soybean yield was negatively impacted by a winter cover crop. Cover crop did not affect corn silage yield.



crop does not significantly impair the cash crop is necessary for widespread adoption.

Method

To study this question, six sites were established in the fall of 2008 and six more in 2009, and 10 were maintained through 2011. The 2010-2011 sites were located at Harlan (SW), Coon Rapids (West Central), Jefferson (West Central), Plainfield (NE), Clutier (East Central), Fort Dodge (Central), Kalona (SE), West Chester (SE), Holstein (NW), and New Market (SW). (**Table 1, on page 2**) describes each location's cash crop and cover crop management.

Background

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.

A few of the benefits of cover crops include soil quality improvements by protecting soil from erosion (Lal et al, 1991, Karlen and Cambardella, 1996), increasing soil microbial activity and

cycling nutrients (Karlen and Cambardella, 1996), decreasing excess nitrogen (Kaspar et al., 2007), or adding to soil carbon (Lal et al, 2004).

Iowa's land has lost significant amounts of soil since annual crop farming began. Iowa's average erosion across the state is 5.2 tons/acre/year (Cox et al, 2011) with some areas losing significantly more. Keeping year-round cover, capturing more sunlight to grow plants that build soil, and capturing any excess nitrogen are things cover crops do and are potential ways to stop soil and nutrient loss.

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

Depending on when they initiated the study, all sites planted a winter hardy rye cover crop in the fall of 2008 and/or 2009 and again in all succeeding years of the study. Winter rye planted was sourced through local seed retailers, the previous year's seed, or farmers used the improved variety 'wheeler,' a variety bred at Michigan State University. Farmers planted cover and no cover strips replicated across the field in the fall of each year in the same location. Two locations used a pseudo-replicated

design since plots were aerial seeded. Farmers either aerial seeded into standing cash crops, drilled the cover crop following cash grain or corn silage harvest, or broadcast the cover crop seed with dry fertilizer. In the spring of 2011, to terminate the cover crop, farmers either used an herbicide as a “burn-down” before or on the cash crop planting date, or used multiple tillage passes before cash crop planting. In the spring before the cover crop was killed, four 1-ft² quadrates per plot were used to collect samples of the above-ground biomass, which were dried and weighed.

Nitrogen concentration of the cover crop biomass samples collected in the spring of 2011 was measured to estimate how much nitrogen the cover crop held on the farm. In the fall, farmers combined and weighed grain from individual plots using a weigh wagon or a yield monitor. Yields are reported as: corn in bu/A at 15.5% moisture content; soybean in bu/A at 13% moisture content.

Location	2009 crop	2010 crop	2011 crop	2010-1011 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.

Statistics were analyzed using JMP 9 (SAS Institute Inc., Cary, NC) and yield comparisons employ least squares means for accuracy. Statistical significance is determined at a $\alpha=.05$ level.

Results and Discussion

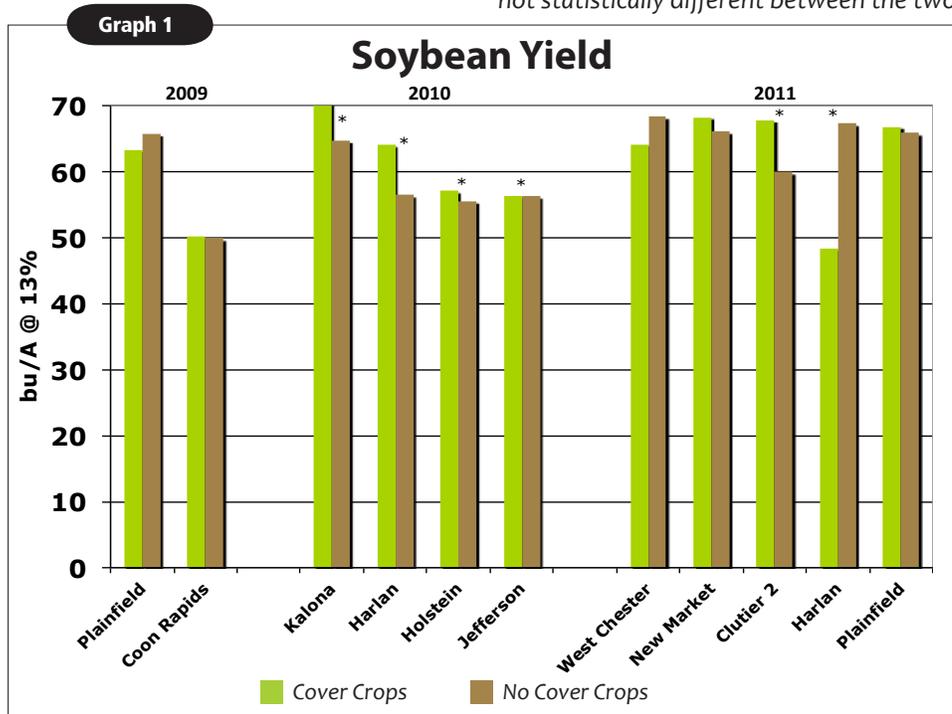
Soybean Yield

Soybean yield ranged from 49.9 bu/A in 2009 at Coon Rapids to 70.4 bu/A 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 bu/A in the soybean plots where cover crops had been planted in the fall of 2009 to the spring of 2010. In 2011, no difference in soybean yield was measured at three of the five locations. Soybean yield was greatly reduced at Harlan, yielding 18 bu/A less where cover crops had been planted in the fall of 2010 to the spring of 2011. However, at Clutier soybeans yielded 8 bu/A higher following a cover crop than in the no cover crop strips. Possibly the wet spring followed by a very dry summer and fall could have increased stress to soybean plants at Harlan. Yield data from Coon Rapids is not available for 2011 due to a technical issue.

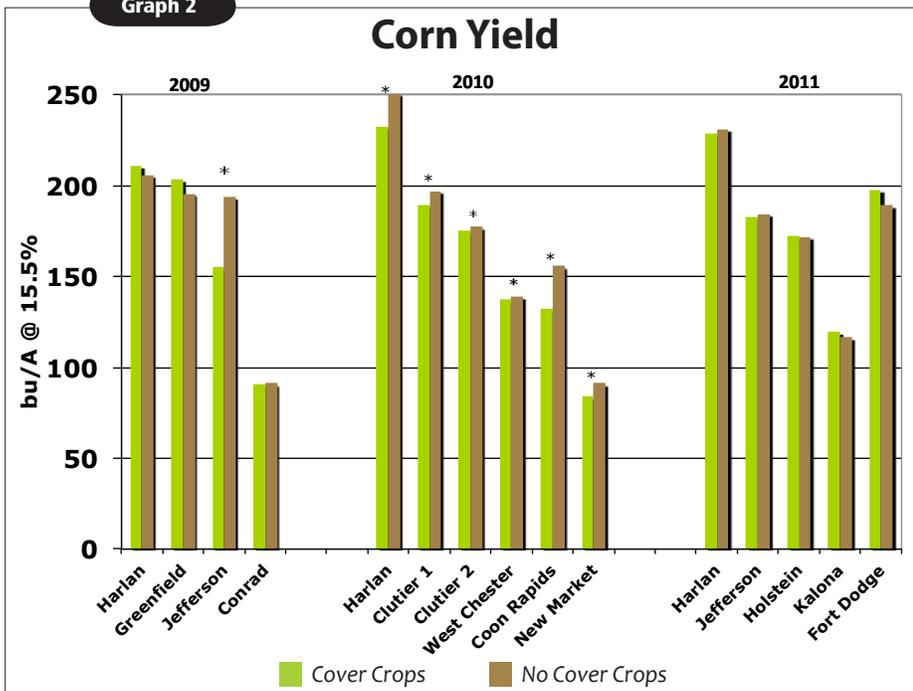
Corn Yield

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



* indicates significant differences using Student’s t-test at an $\alpha=.05$ level.

Graph 2



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

in corn yield of 12 bu/A when following a cover crop across all locations.

Corn Silage

Corn silage yields were not different when grown following a cover crop or no cover crop treatments.

Carbon and Nitrogen Capture

The 711 lbs/A average cover crop biomass determined from spring sampling captured 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 lbs/A to 47.3 lbs/A, greater amounts of aboveground biomass result in greater amount of nitrogen that is captured and stored in the plant material. No correlation resulted between the spring aboveground biomass and its effect on corn or soybean yield. More biomass killed in the spring before corn or soybean planting did not have any effect on the resulting yield of the cash crop. Complete failure to manage the cover crop however was not measured at Jefferson in 2009. This did have a great effect on the cash crop yield. In this study where the cover crop was properly managed, the very presence of the biomass in the spring did not impact

the cash crop yield.

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 and at another 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.

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Graph 3

