



## Weekly Farm Economics: Yield and Yield Risks of Cover Crops in East-Central Illinois

**Gary Schnitkey**

Department of Agricultural and Consumer Economics  
University of Illinois

**Sarah Sellars**

Ness School of Management and Economics  
South Dakota State University

**Laura Gentry**

Department of Natural Resources and Environmental Sciences  
University of Illinois

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We compare average yield and yield risk for high-productivity cover crop and non-cover crop fields in east-central Illinois enrolled in Precision Conservation Management (PCM). For corn, cover crops reduce average yields overall and reduce yield risks. For soybeans, cover crops marginally reduce average yields and have a little to no effect on yield risks.

### Data and Approach

We summarize data from Precision Conservation Management (PCM), a farmer service program led by the Illinois Corn Growers Association and Illinois Soybean Association, in partnership with over 30 entities, including other commodity associations, conservation groups, private foundations, supply chain providers, the Soil and Water Conservation Districts, and the Natural Resource Conservation Service (NRCS). PCM was started in 2015 to address the goals of the Illinois Nutrient Loss Reduction Strategy. The mission of PCM is to help farmers make decisions about adopting on-farm conservation practices in a financially responsible way. Through PCM's regional specialists, PCM works one-on-one with over 300 farmers in Illinois, Kentucky, and Nebraska (see [PCM website](#)).

This article evaluates a subset of PCM fields selected to limit yield differences due to soil productivity, geography, and weather variability. Data are from eleven counties in east-central Illinois. All fields had soil

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productivity ratings of 130 or above. The fields included are the most productive in a highly-productivity agricultural area.

We began the analysis in 2017. In 2017 and each subsequent years, at least 20 fields grew cover crops. The average number of acres summarized for each crop (corn and soybean) in a year is over 50,000 acres. There are an average of over 600 fields for each crop each year. On average, 7% of corn fields had cover crops each year, and 17% of soybean fields had cover crops.

For cover crops, only fields planted to over-wintering species of cover crops are included in the analysis. Winter terminal cover crops are not included to avoid introducing additional variability in yield impacts on the cash crops and because of substantial differences in environmental benefits between over-wintering and winter terminal cover crop species.

For each crop, two measures of yield are presented:

1. Average of all the fields. This average will determine if cover crops impact yields. If yields for no cover crop and cover crop fields are the same, using cover crops does not impact average yield. Cover crops fields will have lowered yields if the average of fields with no cover crops is higher than with cover crops, and vice versa.
2. Average of the 5% lowest fields. This average will determine if cover crops introduce additional risk to the cropping operation because the average yield of the lowest 5% of fields is a measure of risk. If yield for the lowest-yielding (bottom 5%) of fields with and without cover crops is the same, using cover crops does not add risk to the operation. If yield for the lowest-yielding (bottom 5%) of fields with cover crops is lower than the lowest-yielding fields without cover crops, cover crops introduce additional risk to the operation, and vice versa.

## Corn Yields

Corn fields without cover crops had higher yields than fields with cover crops (see Table 1). From 2017 to 2022, corn yields without cover crops averaged 215 bushels per acre, with a high of 227 bushels per acre in 2018 and a low of 197 bushels per acre in 2019. Fields with cover crops averaged 206 bushels per acre for the 2017-2022 period, 9 bushels lower yield than fields without cover crops. Differences in cover crop fields range from 3 bushels per acre in 2019 to 20 bushels per acre in 2018.

**Table 1. Yields for Corn Fields With and Without Cover Crops, High-Productivity Soils in East Central Illinois, Precision Conservation Management<sup>1</sup>**

Year	Average of All Fields			Average of 5% Lowest Yielding Fields		
	Without Cover Crop	With Cover Crop	Diff	Without Cover Crop	With Cover Crop	Diff
2017	213	206	7	143	160	-17
2018	227	207	20	163	156	7
2019	197	194	3	121	144	-23
2020	209	200	9	139	153	-14
2021	218	208	10	150	169	-19
2022	226	221	5	168	170	-2
Average	215	206	9	147	159	-12

<sup>1</sup> Includes over-wintering cover crops. None over-wintering species are not included in the analysis.

Among the lowest 5% yielding corn fields, non-cover cropped fields averaged 147 bushels per acre and cover cropped fields averaged 159 bushels per acre, 12 bushels higher than without cover crops. Except for 2018, cover cropped fields had a higher average. The largest difference occurred in 2019 when cover cropped fields averaged 23 bushels per acre higher than fields without cover crops. The 2019 growing season was unusual in that wet weather in spring delayed planting. Risks of low yields were not heightened by having cover crops for fields in the dataset.

The average in Table 1 suggests that using cover crops reduced average yields. However, the use of cover crops did not increase yield risk. In fact, the use of cover crops increased yields in the lowest 5% of yields. Overall, these results suggest that the use of cover crops in corn reduced downside yield risk.

### Soybean Yields

Soybean fields without cover crops averaged 67 bushels per acre, 2 bushels higher than the 65 bushel per acre average for fields without cover crops (see Table 2). Further investigation of yields suggests that lower yields with cover crops may be due to the practice of no-till more commonly used with cover cropped fields than non-cover cropped fields. In the PCM dataset, no-till is correlated with a slight negative impact on yields compared to use of tillage (see Sellars).

**Table 2. Yields for Soybeans Fields With and Without Cover Crops, High-Productivity Soils in East Central Illinois, Precision Conservation Management<sup>1</sup>**

Year	Average of All Fields			Average of 5% Lowest Yielding Fields (2)		
	Without Cover Crop	With Cover Crop	Diff	Without Cover Crop	With Cover Crop	Diff
2017	63	65	-2	22	24	-2
2018	72	68	4	26	23	3
2019	60	59	1	18	19	-1
2020	65	63	2	22	20	1
2021	71	69	2	25	22	2
2022	69	68	1	25	27	-2
Average	67	65	2	23	22	1

<sup>1</sup> Includes over-wintering cover crops. None over-wintering species are not included in the analysis.

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Across all years, the average of the 5% lowest yielding fields was 23 bushels per acre without cover crops, 1 bushel higher than the average of fields with cover crops (see Table 2). Differences in average vary by year. Averages were higher without cover crops in 2018, 2020, and 2021. Averages were higher with cover crops in 2017, 2019, and 2022.

### Summary and Commentary

Average yields are reduced for corn produced with overwintering cover crop species. While cover crops lowered average corn yield overall, average yields for the lowest 5% yielding fields in the sample demonstrated that cover cropped fields had higher average yields than non-cover cropped fields suggesting that cover crops raised the average of the lowest yielding fields. The use of cover crops actually reduced yield risk in the lowest-yielding fields. The use of cover crops may provide buffering capability, reducing downside risks.

For soybeans, cover crops marginally reduced average yields and the average of the lowest-yielding fields. The yield reductions could result from higher use of no-till on fields with cover crops. Cover crops do not have large impacts on yields and risks for soybean fields.

## **References**

Sellars, Sarah. *Three Essays on the Economic and Environmental Impacts of Production Practices on Cornbelt Agriculture*, University of Illinois, Ph.D. thesis. August 2023.