

Putting Data to Work

What Cover Crop Carbon Really Costs and Pays

Evidence from Illinois corn fields in Precision Conservation Management



College of Agricultural,
Consumer &
Environmental Sciences

UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN



Precision Conservation Management

PrecisionConservation.org

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Gary Schnitkey



Saurav Raj Kunwar



Laura Gentry

Key Acronyms Used

PCM: Precision Conservation Management

SPR: Soil Productivity Rating

GHG: Greenhouse Gas

tCO₂e: Tons of Carbon Dioxide Equivalent

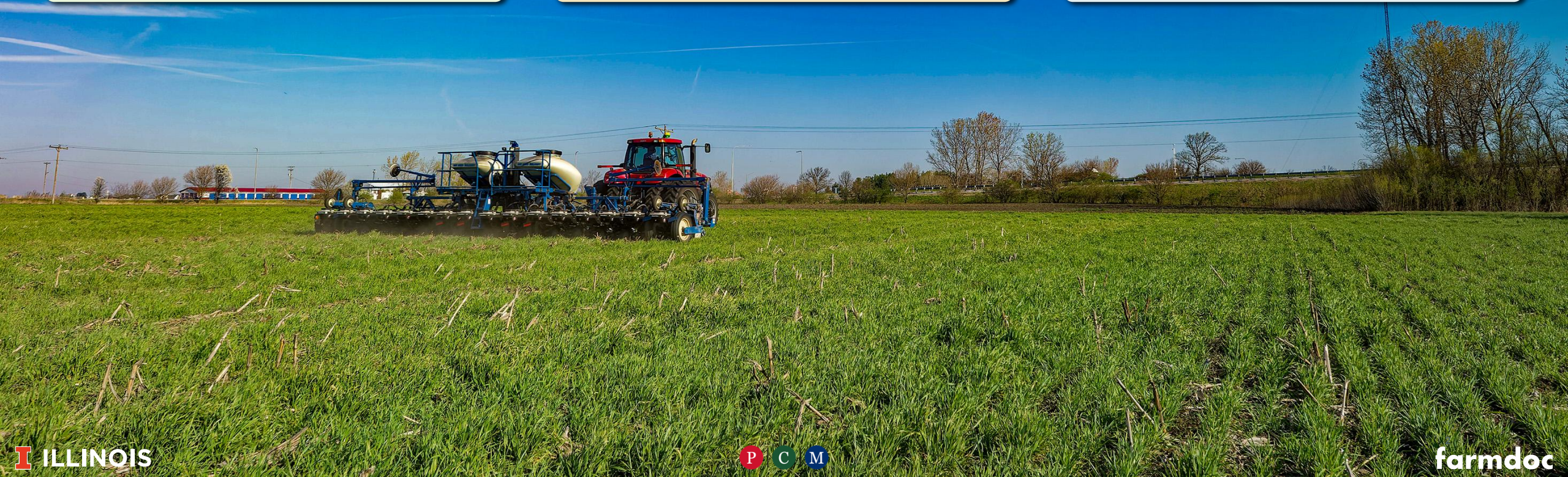
MRTN: Maximum Return to Nitrogen

Why incentives matter across the supply chain

Grower

Food Company

Public Program



What Is PCM?

We help farmers leverage field data for greater profitability & environmental outcomes.



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Farmer Benefits



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Data Analysis

Field-level analysis of the economic and environmental outcomes of each practice.

Technical Assistance

From data collection to **profitable recommendations**, **we're here to help.**

Incentive Programs

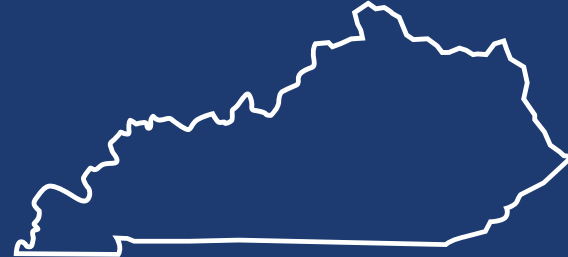
Pay-for-practice incentives can make conservation practice adoption less risky.

PCM Today

PCM now
serves farmers
in 4 states

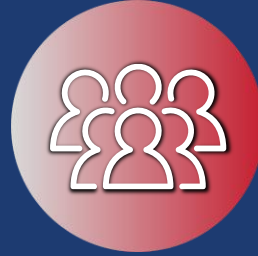


Precision Conservation Management



PCM works with farmers in primary watersheds in Illinois, Kentucky, Missouri and Nebraska.

PCM in 2025



620
farmers enrolled



681,765
acres assessed



30+
partners

PCM Practice Standards

Identifying win-win in-field practices

We focus on in-field practices that have the greatest impact on soil health and water quality. With a focus on **profitability over yield**, we help farmers identify practices that benefit both the environment and their bottom line.



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Cover Crops

PCM's Traditional Analysis Approach



Corn HIGH-SPR 2015-25 AVG VALUES			
	OVERWINTERING	WINTER TERMINAL	NO COVER CROP
# of fields	917	433	8,206
Yield per acre	222	225	228
Soil Productivity Rating (SPR)	138	140	139
GROSS REVENUE	\$953	\$958	\$969
COVER CROP SEED	\$17	\$16	\$0
TOTAL DIRECT COSTS*	\$476	\$463	\$466
COVER CROP PLANTING	\$12	\$15	\$0
Other power costs**	\$117	\$119	\$120
TOTAL POWER COSTS	\$129	\$134	\$120
OVERHEAD COSTS	\$43	\$42	\$42
TOTAL NON-LAND COSTS	\$648	\$640	\$628
OPERATOR & LAND RETURN	\$280-\$330	\$294-\$344	\$341
Estimated soil loss (tons/a)	1.06	1.06	1.56
GHG emissions (metric tons CO2e/a)	0.82		1.27



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Cover Crops

An Enhanced Analysis Approach



Cover crops link farm decisions to carbon services

Production changes

- Seed, planting, and termination costs
- Changes in nitrogen use and field operations
- Possible changes in corn yield and revenue

Our enhanced analysis estimates that field-specific cost by accounting for carbon stored, emissions reduced, and the field's production trade-offs.

Carbon services

- More carbon stored in soil
- Lower GHG emissions

The key question: How much does it cost farmers to provide carbon services?

American Journal of
Agricultural Economics



Article | [Open Access](#) |

What are the carbon services from cover-crop adoption worth from farmers' perspective?

[Saurav Raj Kunwar](#) ✉ [Robert G. Chambers](#), [Laura F. Gentry](#), [Teresa Serra](#)

First published: 09 July 2025 | <https://doi.org/10.1111/ajae.70005> | [VIEW METRICS](#)

Cover-crop carbon services require about \$27 per acre more

Relative to fields without cover crops

Estimated additional minimum compensation:

\$27.30 per acre

*Compared with non-cover-crop fields,
cover-crop fields provide more carbon services at a higher private cost.*

**This estimate captures the combined private cost
of providing carbon services at the field level.**

Next:

1. Data that allowed us to estimate the cost
2. Breakdown of the cost into carbon storage cost and GHG emissions reduction cost

Using Grower Data Responsibly

- PCM data under a data-use agreement.
- No farm, field, or grower is identified in our analysis.
- Results are reported across groups of fields, not individual operations



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Study data and confidentiality

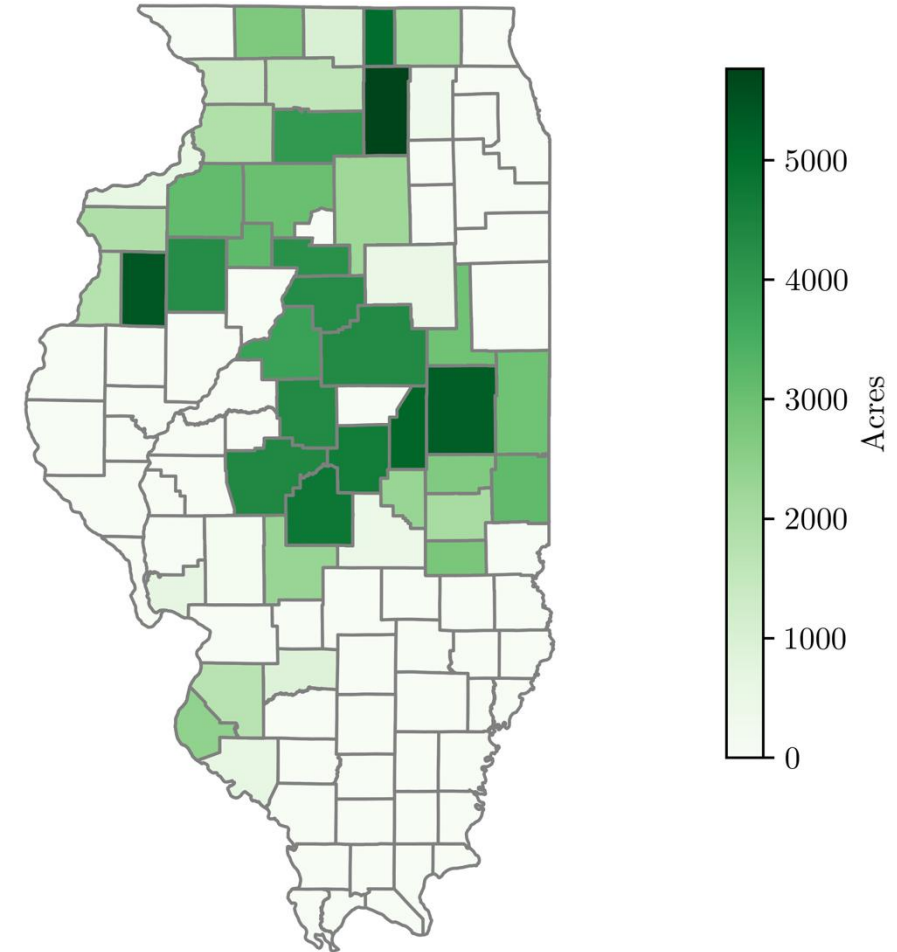
Illinois corn fields in 2021

159
growers

46
Illinois counties

51,700
acres

793
corn fields



120 fields with cover crops | 673 fields without cover crops

How the Two Field Types Compare in Our Sample

Median values per acre

Metric	Non cover crop fields	Cover crop fields	Difference
Carbon stored, tCO ₂ e/acre	0.12	0.55	+0.43
GHG emissions, tCO ₂ e/acre	0.25	0.24	-0.01
Nitrogen, lbs./acre	207	195	-12
Power costs*, \$/acre	\$121	\$137	+\$16
Yield, bushels/acre	218	204	-14
Revenue, \$/acre	\$1,155	\$1,105	-\$50
SPR	131	127	-4

** Power costs include costs related to mechanized fieldwork, such as corn and cover-crop planting, corn harvest, and cover-crop termination*

Cover crops, Nitrogen management and MRTN

Cover crop



No Cover crop

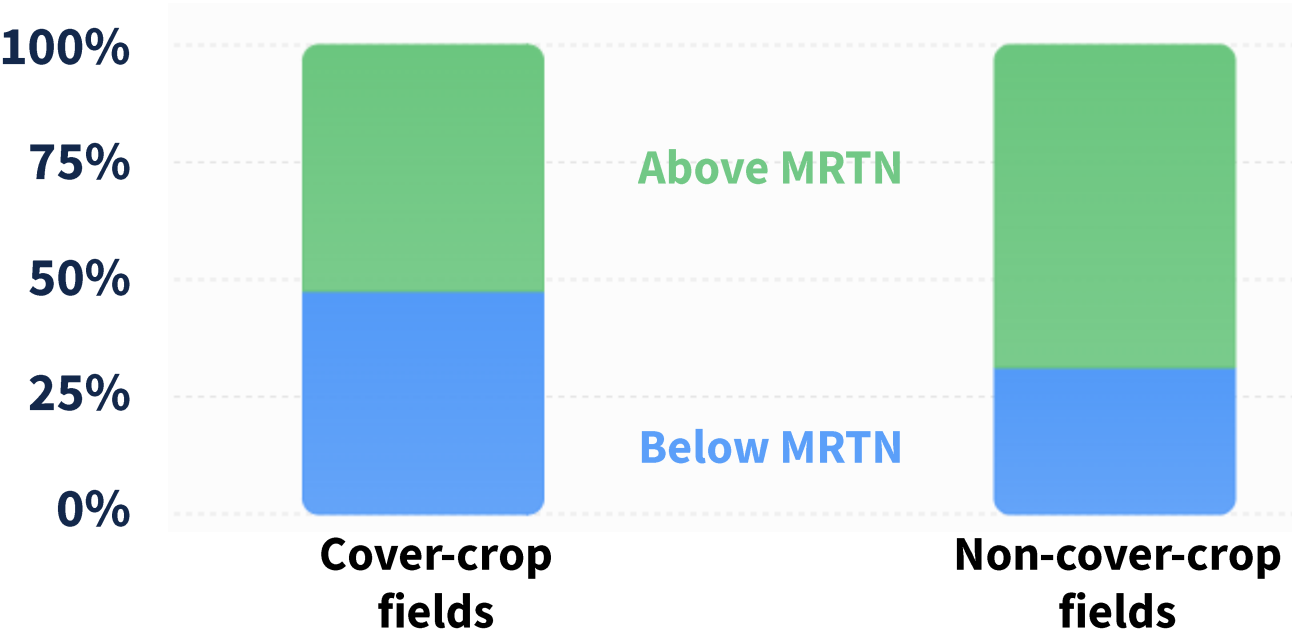


Median nitrogen applied per acre
Cover-crop fields applied less nitrogen and were less likely to exceed the university-recommended MRTN rate than non-cover-crop fields.

MRTN is the nitrogen rate associated with the maximum expected economic return.

Nitrogen use relative to MRTN

Share of corn fields below or above the maximum return to nitrogen rate, by cover-crop use.

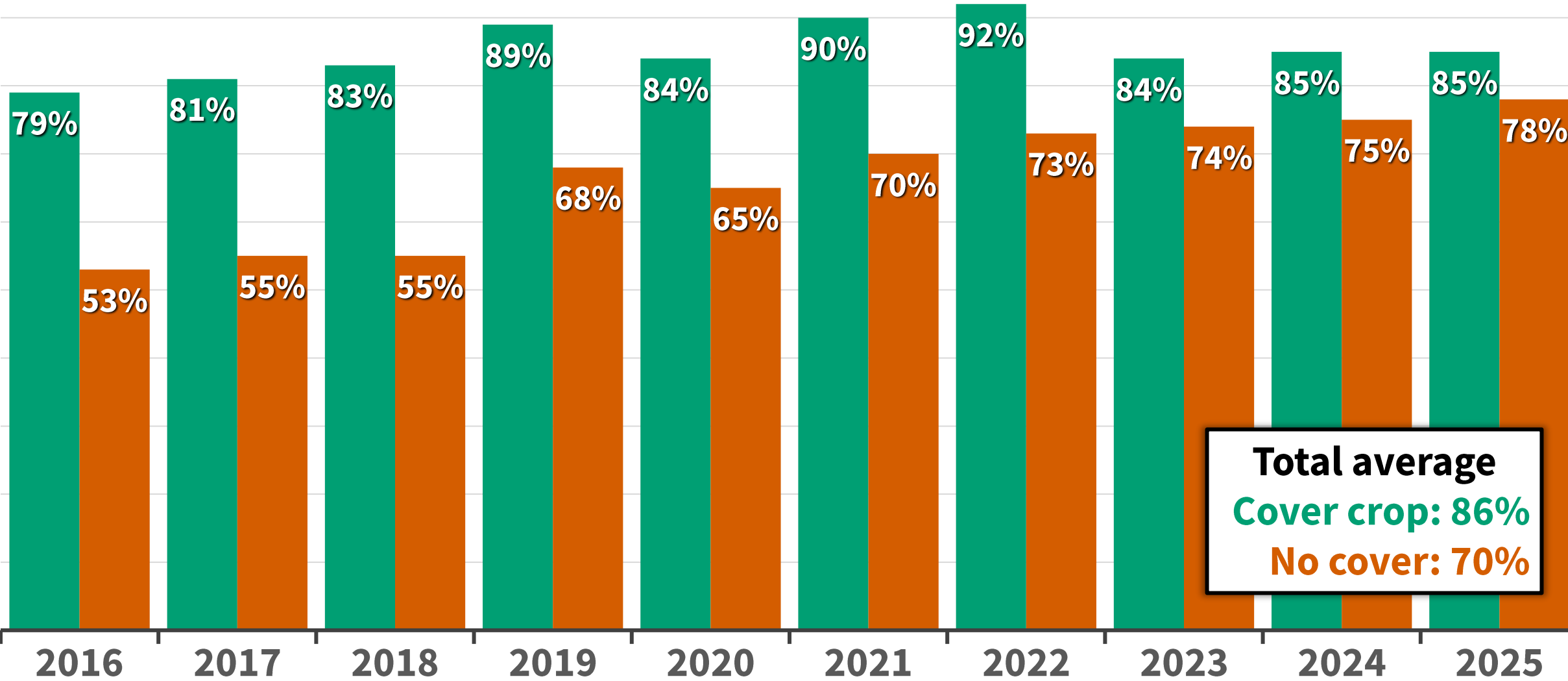


53% of cover-crop fields exceeded MRTN, compared with 69% of non-cover-crop fields

Share of Illinois PCM Corn Acres using conservation tillage (%)

by Cover-Crop Class & Year

■ Cover-crop acres ■ Acres without cover crops



Total average
Cover crop: 86%
No cover: 70%

How We Valued Carbon Services from Cover Crops?

Calculate the minimum payment that reflects the field-level trade-off between:

- Carbon services and production



The minimum marginal compensation is the smallest payment that leaves the grower no worse off after providing an additional carbon service.

The \$27.30 per acre decomposition: Where the cost differences come from

**Carbon-service
value**

**Adding soil carbon
\$17.88**

**Cutting GHG
emissions
\$9.42**

Keeping our costs focused on cover crops

Problem: Are cover-crop fields different because of cover crops, or because they have better soil or management?

How did we solve it?

- We compare each cover-crop field with well-managed fields that have similar growing conditions.
- This makes the comparison fair when fields differ in soil, yield potential, or fieldwork.
- For example, better soil should not get credit for carbon gains that did not come from the cover crop.
- What remains is the added carbon service linked to cover crops.

What the \$27.30 per acre estimate excludes

Included

- Soil-carbon sequestration
- GHG emissions reduction

Excluded

- Reduced soil erosion
- Improved soil structure
- Reduced nitrogen/phosphorus runoff

The estimate is deliberately limited to carbon services and should not be read as the full value of cover crops.

PCM's Soil Health Incentives

Farmers for Soil Health



Year 1	\$35
Year 2	\$35
Year 3	\$35



Soil Health Incentives

Cover Crops	\$15/acre (year 1&2) \$10/acre (year 3+)
Tillage Reductions	\$10/acre (year 1&2) \$5/acre (year 3+)
10% N reduction	\$10/acre 1 st year



How far the result travels

Illinois corn only

One year: 2021

Voluntary PCM sample

**Less than 1%
of Illinois corn acres**

**Treat the estimates as evidence for this setting,
not as automatic results for another crop, state, or year.**

Takeaway

Cover crops provide measurable carbon services but supplying them has a private cost to growers.

Carbon payments can help cover part of that cost.

Broader conservation incentives can help growers approach that gap while recognizing benefits beyond carbon.

Thanks to PCM, participating growers, and the coauthors.

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