# The Business Case for Conservation

### Low-SPR Data Analysis

2015-2023 Data Summary



Precision Conservation Management

A program of the IL Corn Growers Association and the Illinois Soybean Association

SPR = Soil Productivity Rating



### About PCM Data

Precision Conservation Management (PCM) now represents almost 25,000 corn and soybean field-years (over 2.2 million acres) in Illinois from 2015-2023. PCM was launched in 2015 with a single region in east-central Illinois. Today, PCM serves farmers in 11 regions throughout Illinois, Nebraska, and Kentucky!

PCM began as a response to the Illinois Nutrient Loss Reduction Strategy, so we focused our initial efforts on understanding nitrate-nitrogen and phosphorus losses from agricultural fields in the most intensively tile-drained parts of Illinois. These areas were also the most highly productive soils in the state, which meant that early PCM data had far more high-productivity fields relative to lower-productivity fields. In 2020, we intentionally expanded PCM service regions into parts of the state with lower soil productivity ratings (SPR), and in 2023 we finally had almost equal numbers of lower-productivity and higher-productivity fields. PCM assigns soil productivity ratings according to University of Illinois Extension Bulletin 810, and we assign fields with area-weighted SPR scores less than 135 as "low productivity" and those with scores equal to or greater than 135 as "high productivity."

This year, we are thrilled to offer a low-SPR data analysis in addition to our annual high SPR data publication! In the following tables and charts, we summarize financial and environmental outcomes for the lower-productivity soils of Illinois for the three different practice standards in PCM: tillage, cover crops, and nitrogen management. We also assess which practices are being used among the most profitable corn and soybean fields in PCM.

Profitability trends for tillage, cover crops, and nutrient management can change from year to year but, overall, certain profitability trends remain surprisingly consistent. The long-term goal for PCM data is to provide farmers with accurate, unbiased data that they can rely on to make good financial decisions for their farming operations. **We pride ourselves on providing analysis that is transparent, objective, and, above all, accurate.** As we add more data every year, we are gratified to see emerging trends that remain consistent and predictable over time.

We're excited to share these trends with you and hope that these findings from other Illinois farms will provide the critical information you need to make confident decisions about adopting more conservation-focused practices and systems for your farm.

-Dr. Laura Gentry, Director of Water Quality, IL Corn



## Tillage Data

Looking at all 4,700 low-SPR corn fields in the PCM dataset from 2015-2023, we see that profitability was greatest for those fields that received two tillage passes with lighter, lower-disturbance tillage equipment. **2-Pass Light** has also been the most profitable tillage system for the high-SPR corn fields every year since 2021. Notably, we see 2-Pass Light being \$27 per acre more profitable than the next most profitable class for the low-SPR soils—a bigger gap than we see between tillage classes for high-SPR soils. This indicates that 2-Pass Light has a strong probability of being the most profitable tillage system for lower-SPR fields.

**Strip tillage** also performed well in terms of yields, averaging just 2 bushels per acre less than the 2-Pass Light class.

CORN, Low-SPR (2015-23 avg. values)	NO- TILL	STRIP TILL	1-PASS LIGHT	2-PASS LIGHT	2-PASS MODERATE	2+ TILLAGE PASSES
# fields	1498	720	1275	472	583	168
Yield per acre	191	203	195	205	197	211
GROSS REVENUE	\$824	\$881	\$840	\$888	\$848	\$901
TOTAL DIRECT COSTS*	\$405	\$443	\$418	\$415	\$412	\$441
Field Work	\$0	\$21	\$11	\$25	\$27	\$40
Other power costs	\$106	\$100	\$100	\$99	\$98	\$97
TOTAL POWER COSTS**	\$106	\$121	\$111	\$124	\$125	\$137
OVERHEAD COSTS	\$39	\$39	\$39	\$39	\$39	\$39
TOTAL NON-LAND COSTS	\$551	\$604	\$569	\$578	\$576	\$618
OPERATOR & LAND RETURN	\$273	\$277	\$272	\$310	\$272	\$283
Estimated Soil Loss (Tons/a)	0.99	0.77	1.76	1.85	2.00	2.38
GHG emissions (metric tons CO2e/a)	0.57		0.95			

**No-Till** = no tillage; **Strip Till** = less than full-width tillage of varying intensity; **1-Pass Light** = 1 pass w/low-disturbance tillage; **2-Pass Light** = 2 passes w/low-disturbance tillage; **2-Pass Moderate** = 2 passes (1 low-disturbance tillage + 1 high-disturbance tillage); **2+ Tillage Passes** = more than 2 tillage passes, any intensity level.

\*Direct Costs = fertilizers, pesticides, seed, cover crop seed, drying, storage, and crop insurance



### Tillage Data

Of the 4,500 low-SPR soybean fields in the PCM dataset from 2015-2023, the most profitable tillage class was **Strip Till**; however, a bit of caution must be advised since this tillage class represented a very small number of fields in the PCM dataset. Also, most of the strip tillage fields in our low-SPR dataset come from years when soybean production was highly profitable which, in the short term, artificially inflates the actual average profitability of strip tillage relative to other tillage classes.

Tied with strip tillage for yield is the **2+ Pass** class. **No-Till**, which represented the largest number of soybean fields in the low-SPR dataset (by far), produced 2-3 bushels per acre less than the more profitable tillage classes but also had much lower power costs. Savings in field work alone ranged from \$22-44 per acre. No-Till can easily be the most profitable tillage class when yields can be maintained in 63-65 bushels per acre range.

SOYBEANS, Low-SPR (2015-23 avg. values)	NO- TILL	STRIP TILL	1-PASS LIGHT	2-PASS LIGHT	2-PASS MODERATE	2+ TILLAGE PASSES
# fields	2940	29	620	287	398	267
Yield per acre	62	65	61	63	64	65
GROSS REVENUE	\$655	\$770	\$653	\$676	\$677	\$690
TOTAL DIRECT COSTS*	\$173	\$226	\$167	\$163	\$163	\$157
Field Work	\$0	\$22	\$12	\$25	\$26	\$44
Other power costs	\$80	\$91	\$75	\$73	\$71	\$72
TOTAL POWER COSTS**	\$80	\$113	\$88	\$98	\$97	\$116
OVERHEAD COSTS	\$33	\$35	\$33	\$33	\$33	\$33
TOTAL NON-LAND COSTS	\$286	\$374	\$287	\$293	\$292	\$305
<b>OPERATOR &amp; LAND RETURN</b>	\$369	\$395	\$366	\$382	\$385	\$385
Estimated Soil Loss (Tons/a)	1.55	1.38	1.67	3.49	3.60	3.97
GHG emissions (metric tons CO2e/a)	-0.23		0.16			

**No-Till** = no tillage; **Strip Till** = less than full-width tillage of varying intensity; **1-Pass Light** = 1 pass w/low-disturbance tillage; **2-Pass Light** = 2 passes w/low-disturbance tillage; **2-Pass Moderate** = 2 passes (1 low-disturbance tillage + 1 high-disturbance tillage); **2+ Tillage Passes** = more than 2 tillage passes, any intensity level.

\*Direct Costs = fertilizers, pesticides, seed, cover crop seed, drying, storage, and crop insurance



### Most Profitable Acres by Tillage Practice

In this analysis, we look at the top 25% most profitable corn & soybean fields with low soil productivity ratings.

For corn fields, the findings for low-SPR soils closely reflect what we have found over the past several years for high-SPR soils. Just as with high-SPR fields, 40% of the most profitable fields are either **No-Till** or **Strip Till. 1-Pass Light Tillage** is the most represented tillage class, at 28% of the most profitable low-SPR corn fields. Just 3% of the most profitable corn fields were managed with **3 or more Tillage Passes.** 

F<u>or soybean fields</u>, 60% of the most profitable low-SPR soybean fields were **No-Till** (compared with 43% of high-SPR fields), and 16% of the most profitable fields were managed with **1-Pass Light Tillage**. Like the most profitable corn fields, just 4% of the most profitable soybean fields were managed with **3 or more Tillage Passes**.





### Cover Crop Data

In our low-SPR analysis ahead of both corn and soybean crops, cover crops just can't be demonstrated to pay for themselves without, at a minimum, help from incentive payments. Please note that the fields in our analysis are often new to cover crops, as are the farmers who are using them. So, we are not suggesting that these tables represent the best-case scenario for cover crops in Illinois.

Having said that, planting winter terminal cover crops like oats ahead of corn on low-SPR soil shows promise for maintaining profitability. These are also generally low-cost cover crop seeds and easy to manage since no termination is needed ahead of planting.

CORN, Low-SPR (2015-23 avg. values)	OVERWINTERING	WINTER TERMINAL	NO COVER CROP
# fields	671	173	3846
Yield per acre	195	205	200
Soil Productivity Rating	115	121	117
GROSS REVENUE	\$832	\$923	\$861
COVER CROP SEED	\$14	\$16	\$0
TOTAL DIRECT COSTS*	\$421	\$459	\$419
COVER CROP PLANTING	\$13	\$15	\$0
Other power costs	\$122	\$112	\$114
TOTAL POWER COSTS**	\$135	\$127	\$114
OVERHEAD COSTS	\$39	\$40	\$39
TOTAL NON-LAND COSTS	\$595	\$626	\$573
<b>OPERATOR &amp; LAND RETURN</b>	\$210-260	\$274-324	\$288
Estimated Soil Loss (Tons/a)	1.76	1.16	1.57
GHG emissions (metric tons CO2e/a)	0.31		0.73

**\*Direct Costs** = fertilizers, pesticides, seed, cover crop seed, drying, storage, and crop insurance



### Cover Crop Data

We know many farmers are growing cover crops on lower-productivity soils across the Midwest and that these farmers are convinced that cover crops improve their soils, yields, and resiliency to drought and flooding; overall, these cover crop proponents have increased their farms' profitability and productivity with cover crops. The PCM dataset has not been able to capture those benefits—*yet*. Also note that these tables do *not* account for incentive payments available through programs like PCM which can ease the financial strain on farmers.

When planting cover crops ahead of soybeans, your best bet is to choose an overwintering species like cereal rye and terminate in the spring.

SOYBEANS, Low-SPR (2015-23 avg. values)	OVERWINTERING	WINTER TERMINAL	NO COVER CROP
# fields	1258	50	3216
Yield per acre	63	59	62
Soil Productivity Rating	116	114	117
GROSS REVENUE	\$664	\$639	\$662
COVER CROP SEED	\$14	\$16	\$0
TOTAL DIRECT COSTS*	\$181	\$180	\$167
COVER CROP PLANTING	\$14	\$13	\$0
Other power costs	\$92	\$90	\$83
TOTAL POWER COSTS**	\$106	\$104	\$83
OVERHEAD COSTS	\$33	\$33	\$33
TOTAL NON-LAND COSTS	\$319	\$317	\$283
<b>OPERATOR &amp; LAND RETURN</b>	\$318-\$368	\$296-\$346	\$379
Estimated Soil Loss (Tons/a)	1.91	1.90	2.32
GHG emissions (metric tons CO2e/a)	-0.44	-0.05	

\*Direct Costs = fertilizers, pesticides, seed, cover crop seed, drying, storage, and crop insurance



# Nitrogen Timing (North of I-70)

Interstate 70 is often considered the "boundary" between central and southern Illinois because there is a well-recognized University of Illinois declaration that nitrogen fertilizer should not be applied in the fall south of I-70 due to increased risk of nitrogen losses resulting primarily from warmer soils. We found it useful to dissect low-SPR nitrogen timing data into fields "north of I-70" and "south of I-70" to isolate fields that have access to fall nitrogen fertilizer applications from those that do not.

<u>North of I-70</u>: Over 70% of low-SPR fields north of I-70 receive the majority of nitrogen as either **Mostly Preplant** or **Mostly Sidedress** applications. The **Mostly Fall** nitrogen class, while competitive with the other nitrogen timing classes on low-SPR soils, may not be as consistently profitable as many farmers think once the additional risks of higher fertilizer rates and stabilizers are factored in.

CORN, Low-SPR North of I-70 (2015-23 avg. values)	>40% FALL	MOSTLY PREPLANT	MOSTLY SIDEDRESS	50%PRE/ 50% SIDEDRESS	3-WAY SPLIT
NUE ([b N/bu grain)	1.04	1.03	0.98	0.99	1.07
# fields	936	1142	1135	253	296
Yield per acre	208	196	201	205	199
GROSS REVENUE	\$901	\$846	866	894	858
N fertilizer	\$101	\$92	\$95	\$105	\$102
Other direct costs*	\$341	\$317	\$324	\$320	\$346
TOTAL DIRECT COSTS*	\$442	\$409	\$419	\$425	\$448
Field Work	\$18	\$15	\$14	\$23	\$17
Other power costs	\$102	\$98	\$102	\$102	\$101
TOTAL POWER COSTS**	\$120	\$113	\$116	\$125	\$118
OVERHEAD COSTS	\$39	\$39	\$39	\$40	\$39
TOTAL NON-LAND COSTS	\$601	\$561	\$574	\$590	\$605
OPERATOR & LAND RETURN	\$300	\$285	\$292	\$304	\$253

**NUE** = nitrogen use efficiency

\*Direct Costs = fertilizers, pesticides, seed, cover crop seed, drying, storage, and crop insurance



### Nitrogen Timing (South of I-70)

<u>South of I-70</u> (i.e. those fields which should not receive fall nitrogen fertilizer applications): We need to be careful with our interpretation of the average profitability results here. There are a few complicating factors that should be considered. The **Mostly Sidedress** and **50/50 Preplant/Sidedress** classes are essentially equal in terms of Operator and Land Return, but we must note that there are far fewer fields representing the **50/50 Preplant/Sidedress** class. Additionally, the majority of those fields were added to the dataset during the highly profitable cropping seasons of 2021-2023, which can artificially inflate the final profitability of that class.

Generally speaking, we see that the **Mostly Sidedress** nitrogen management class reliably produces high yields with a moderate nitrogen application rate (for both high- and low-SPR soils). Since this inseason application is also a great practice to help reduce nutrient losses and protect local water quality, it's a safe bet for low-SPR soils south of I-70 in Illinois.

CORN, Low-SPR South of I-70 (2015-23 avg. values)	MOSTLY PREPLANT	MOSTLY SIDEDRESS	50%PRE/ 50% SIDEDRESS
NUE ( <mark>lb</mark> N/bu grain)	1.07	1.03	0.92
# fields	542	228	36
Yield per acre	175	185	167
GROSS REVENUE	\$770	\$839	\$906
N fertilizer	\$90	\$101	\$123
Other direct costs*	\$267	\$304	\$339
TOTAL DIRECT COSTS*	\$357	\$405	\$462
Field Work	\$22	\$9	\$8
Other power costs	\$98	\$103	\$108
TOTAL POWER COSTS**	\$120	\$112	\$116
OVERHEAD COSTS	\$40	\$41	\$44
TOTAL NON-LAND COSTS	\$517	\$557	\$622
<b>OPERATOR &amp; LAND RETURN</b>	\$253	\$282	\$284

**NUE** = nitrogen use efficiency

\*Direct Costs = fertilizers, pesticides, seed, cover crop seed, drying, storage, and crop insurance



## Nitrogen Rates

The two most profitable nitrogen application rates for low-SPR soils were the **<= 150 lb N/a class** (net return=\$293 per acre) and the **176-200 lb N/a class** (net return=\$292 per acre). If you are applying more than a total rate of 200 lb N/a on low-SPR soils, do yourself a favor and run (don't walk) to your nearest PCM specialist and tell them you'd like to learn more about **PCM's nitrogen fertilizer reduction payments**. You can save money TWO ways: save up to \$20 per acre in nitrogen fertilizer costs AND receive a nitrogen reduction incentive payment from one of PCM's partners in exchange for the carbon credits you are generating by reducing your nitrogen fertilizer rate. Win-win!

CORN, Low-SPR (2015-23 avg. values) N Rate lbs/a	<150	151-175	176-200	201-225	>225
# fields	246	646	1533	1534	836
AVG. CORN YIELD (bu/a)	178	192	197	200	207
OPERATOR & LAND RETURN	\$293	\$285	\$292	\$278	\$266
GHG emissions (metric tons CO2e/a)	0.28	0.46	0.65	0.68	0.85



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Nitrogen Use Efficiency has told me that I have to look at the whole picture: nitrogen applications, cover crops, and tillage. **Not chasing bushels per acre, but profit per acre.** It shows that good management pays real dividends.

Norm Deets, Ogle County, Illinois



### Most Profitable Acres by N-Management

There is a well-recognized University of Illinois declaration that nitrogen fertilizer should not be applied in the fall south of I-70 due to increased risk of nitrogen losses resulting primarily from warmer soils.

Most profitable low-SPR corn fields north of I-70: The majority apply nitrogen fertilizer at a rate that maintains a Nitrogen Use Efficiency value in the range of 1.0 lb N per bushel or less. Nitrogen application timing was evenly split among the **Mostly Fall**, **Mostly Preplant**, and **Mostly Sidedress** management classes.

MOSTLY PREPLANT

<u>Most profitable low-SPR corn fields south of I-70:</u> The great majority were in the **Mostly Preplant** class and applied at a rate that resulted in a Nitrogen Use Efficiency value of 1.0 lb of N per bushel or less. Farmers applying nitrogen at rates above 200 lb N/a should consider reducing their nitrogen rate to maximize profitability.

50/50 PREPLANT/SIDEDRESS



MOSTLY SIDEDRESS

### TOP 25% MOST PROFITABLE CORN FIELDS NORTH OF I-70

## Lessons & Considerations

We hope that these findings from Illinois farms with low-SPR soil will provide insights to help you make confident decisions about adopting more conservation-focused practices and systems for your farm operation.

For any conservation practice you choose to apply, **the key to optimizing profitability is to keep direct costs as low as possible.** PCM offers incentive payments for reduced tillage, fertilizer management, and cover crops that can help offset costs and protect your bottom line. Consider enrolling in PCM to get personalized data analysis and access to exclusive cost-share programs—there is no requirement to change your current farming practices!

### <u>Tillage</u>

**Strip Till in Soybeans:** This practice is showing promise, but we need more data to more confidently provide recommendations for this practice. We can't discount the possibility that strip tillage for soybean production may be highly profitable. In fact, strip till has been the highest-yielding tillage class in our high-SPR soybean dataset for several years. When you factor in the lower soil erosion and the opportunity for incentive payments of \$5-10 per acre through PCM, strip till for soybeans is worth considering!

**Corn Tillage:** Low-SPR corn fields with 2-Pass Light tillage systems show great promise for profitability. Consider two tillage passes with lighter, lower-disturbance tillage equipment like a vertical tillage tool or a high-speed disc.

**No-Till Soybeans:** While no-till soybeans didn't top the charts for profitability in our data set, the direct power cost savings were significant. Differences in uncontrollable factors like soil productivity and market prices in certain years may be masking the profitability of no-till in our full dataset. A few additional years of data will help us interpret this more accurately. Stay tuned!





PCM is a great resource for my farm when I'm considering a practice change. Whether it be no-till, cover crops, or simply less tillage passes, I can have the confidence to know that other farmers in my area have made changes without profit loss ... Not only do they provide free data, you can also be compensated for practice changes or for simply signing up to share data that won't ever be given to anyone else without my permission.

Elliott Uphoff, Shelby County, Illinois

## Lessons & Considerations

#### **Cover Crops**

At PCM, we are true believers in the great soil erosion and carbon benefits that cover crops provide. **Cover crops are the most effective in-field practice for reducing nutrient losses from fields, thereby protecting water quality and reducing the likelihood of regulatory oversight of our nutrient management practices.** We urge farmers to consider using cover crops on their owned acres, and PCM can help!

PCM offers several different options for helping farmers to overcome financial strain associated with growing cover crops. Talk to your local PCM specialist to see if there's a program that's right for you!

#### <u>Nitrogen</u>

As with the high-SPR soils, the largest corn yields come from those fields with nitrogen fertilizer applied in the fall. However, these systems also apply a greater total rate of N fertilizer, and the larger yields do not fully compensate for the additional costs of the fertilizer itself or the stabilizers that should be applied with fall nitrogen fertilizer.

Additionally, it is well established by University of Illinois researchers and others that fallapplied nitrogen fertilizer, even with a stabilizer, is a substantial contributor to elevated nitrate-nitrogen levels in local water bodies. These local water problems go on to become national water quality problems when the water leaves the state and eventually contributes to the hypoxic zone in the Gulf of Mexico. **Applying nitrogen fertilizer inseason, as preplant or sidedress, is a great way to address water quality issues and help prevent additional nutrient regulations for farmers in the future.** 



Precision Conservation Management

PCM provides enrolled farmers with one-on-one technical support, annual data analysis, and recommendations. We also connect farmers with cost-share programs designed to protect your bottom line when you implement in-field conservation practices.

If you're interested in getting personalized data analysis for your farm or adjusting your practices based on information gleaned from this report, we are here to help!