Tillage, Nitrogen Use, and Cover Crop Impacts of Corn and Soybean Returns

Illinois Corn Growers Association

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Topics

1. What is PCM?
2. PCM Data Collection & Reports
3. Nitrogen: Applications at Maximum Return to Nitrogen (MRTN) Rates Have Highest Returns
4. Tillage & Profitability: Corn & Soybean
5. Cover crops: Lessons for New Adopters

How aware are you of Precision Conservation Management (PCM)?

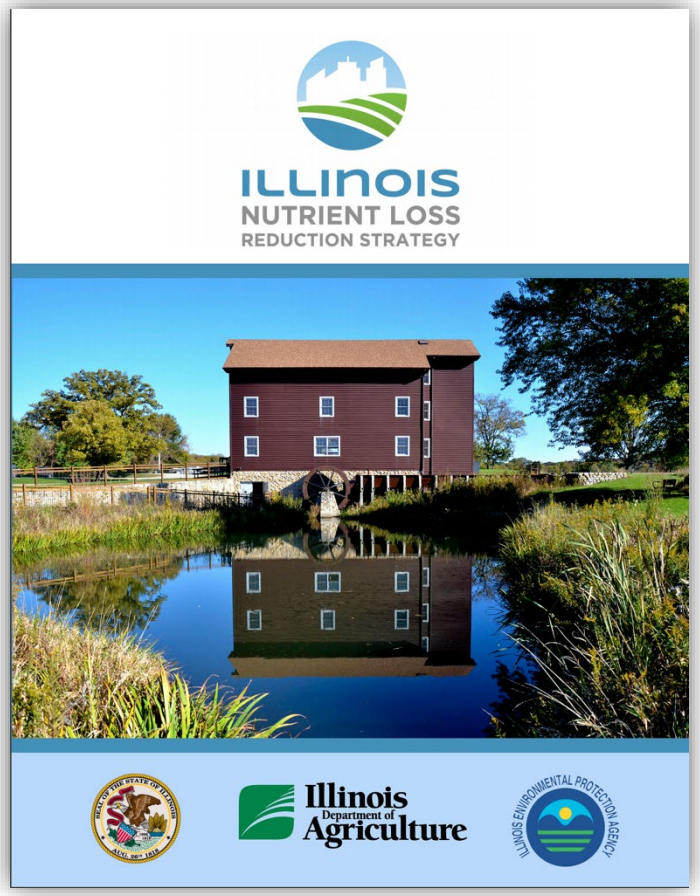
- ○ Not aware
- ○ Heard of it, but know little about PCM
- ○ I have studied results from PCM
- ○ I am very familiar with PCM

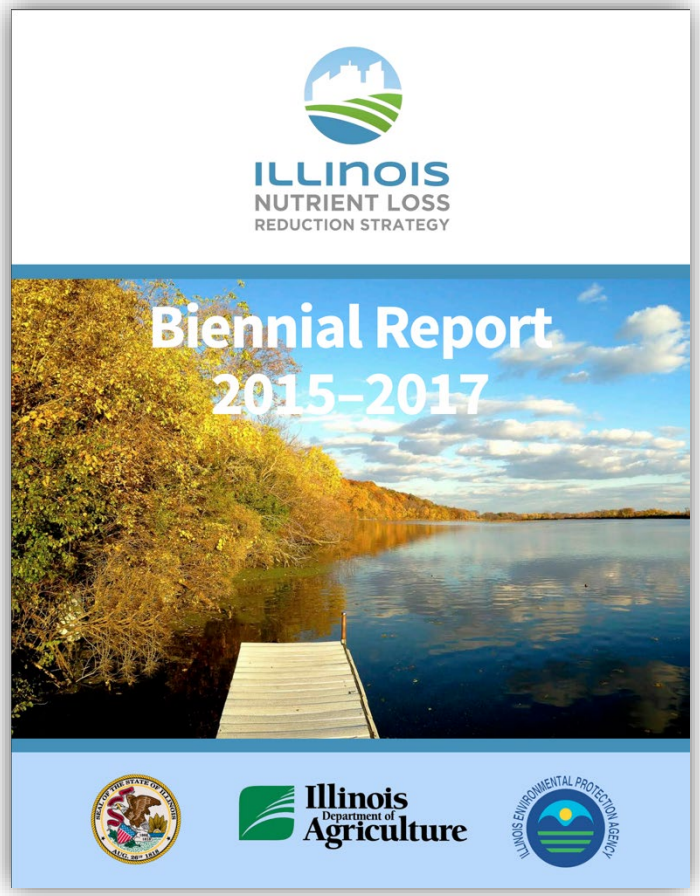
What is PCM?

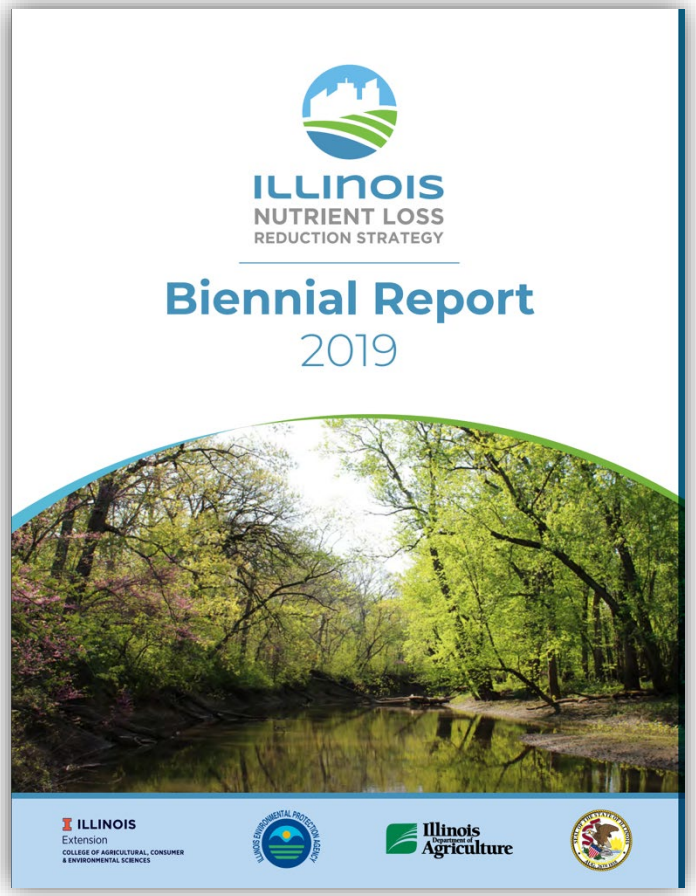
PRECISION CONSERVATION MANAGEMENT

- Understand how conservation practices impact farm net returns
- Address water quality concerns. Prevent agricultural regulation.
- Position farmers to benefit from positive conservation outcomes

Illinois Nutrient Loss Reduction Strategy







Goal: **45% Reduction** in **Total N & Total P** Losses by **2035**

Interim: 15% Reduction in NO_3-N & 25% Reduction in Total P by 2025

Rapid Growth of Companies Setting Science-based Targets Around Sustainability Goals

Companies Tackling Supply Chain Emissions

Food & Tech Companies Showing They Are Serious About Corporate Responsibility

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CORN IL, HIGH SPR 2015-19 AVG VALUES	NO-TILL	STRIP-TILL	1-PASS LIGHT	2-PASS LIGHT	2-PASS MODERATE	2+ TILLAGE PASSES
No. Fields	310	296	710	139	302	46
Yield per acre	209	219	220	224	223	216
GROSS REVENUE	***$750***	***$787***	***$790***	***$804***	***$801***	***$773***
TOTAL DIRECT COSTS*	***$388***	***$395***	***$382***	***$384***	***$396***	***$422***
Field work	$0	$20	$10	$22	$26	$38
Other power costs**	$96	$93	$96	$93	$92	$97
TOTAL POWER COSTS	***$96***	***$113***	***$106***	***$115***	***$118***	***$135***
OVERHEAD COSTS	***$37***	***$37***	***$37***	***$37***	***$37***	***$37***
TOTAL NON-LAND COSTS	***$521***	***$544***	***$524***	***$536***	***$550***	***$594***
OPERATOR & LAND RETURN	$229	$243	$266	$269	$250	$180

Precision Conservation Management

- 16 IL counties
- 10 KY counties
- 330 Farmers in IL
- 300,000+ acres
- 5 years of data
- Farmer enrollment began in 2016

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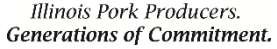
PCM Field Staff

- Staff: Precision Conservation Specialists & Data Collection Representatives
- Partnership effort: 30+ partners
- NRCS RCPP award
- An intuitively designed web interface

PCM PARTNERS

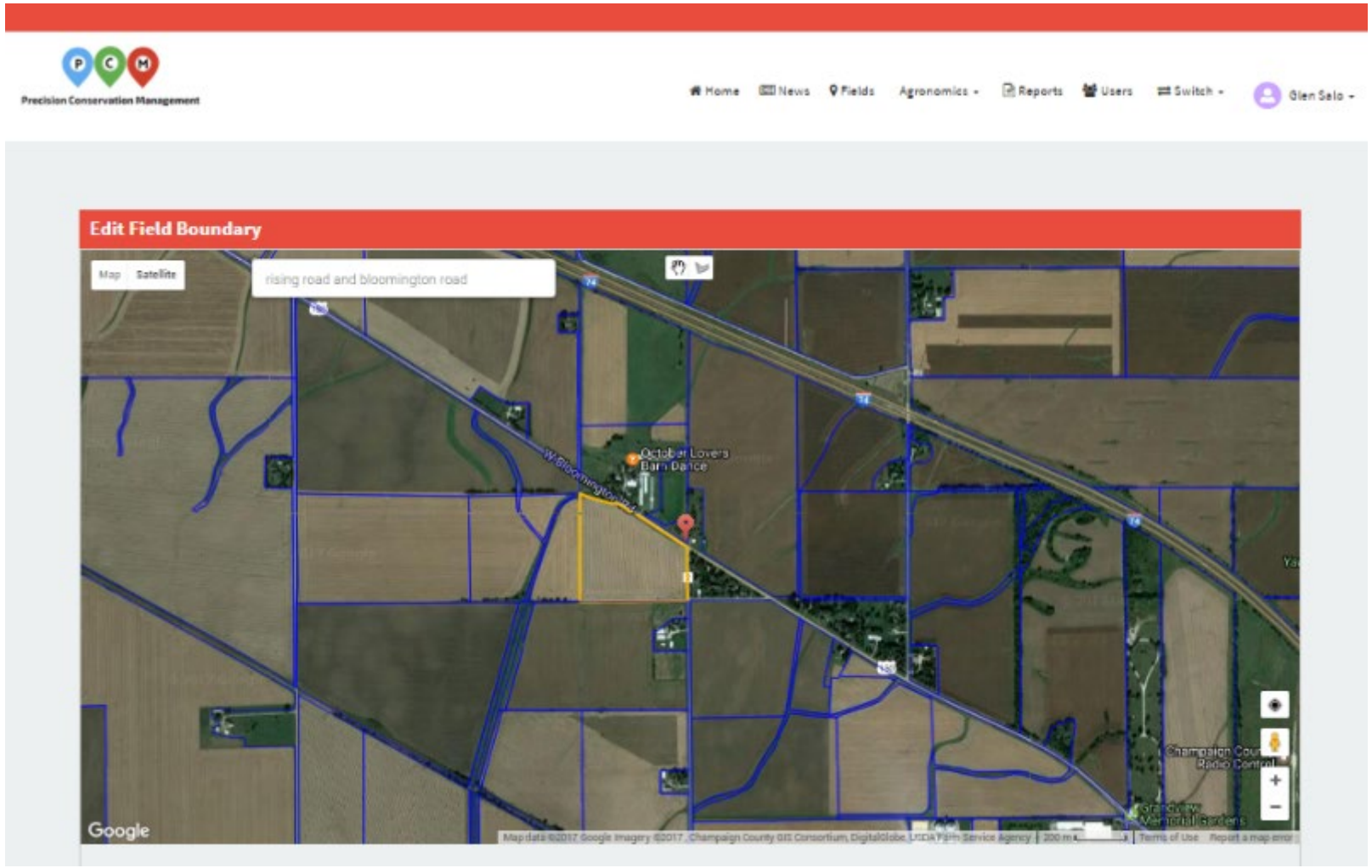


Check us out online: www.PrecisionConservation.ORG

PCM Data Collection & Reports

Data Collection

1. Fields
2. Crops
3. Systems
   - Conventional
   - Non-GMO
   - Seed Corn/Bean
   - Organic/Transitioning
4. Programs
   - Every Pass Across Field
   - Inputs; Rates



PCM Practice Standards

1. Tillage
2. Cover Crops
3. Nutrient Management

Economic returns resulting from various nitrogen fertilizer management strategies for corn production in Central Illinois from 2015-19.

CORN IL, 2015-2019 HIGH SPR	>40% FALL	MOSTLY PREPLANT	MOSTLY SIDEDRESS	50% PRE/50 SIDEDRESS	3-WAY SPLIT
AVG NUE (lb N/bu grain)	1.01	0.93	0.92	0.91	0.94
Yield per acre	219	218	220	221	230
No. Fields	732	492	612	228	52
GROSS REVENUE	***$789***	***$785***	***$791***	***$793***	***$827***
N fertilizer	$84	$78	$76	$84	$95
Other direct costs*	$320	$286	$307	$311	$338
TOTAL DIRECT COSTS	***$404***	***$364***	***$383***	***$395***	***$433***
Field work	$16	$16	$16	$18	$19
Other power costs**	$97	$89	$94	$95	$93
TOTAL POWER COSTS	***$113***	***$105***	***$110***	***$113***	***$112***
OVERHEAD COSTS	***$37***	***$37***	***$37***	***$37***	***$37***
TOTAL NON-LAND COSTS	***$554***	***$506***	***$529***	***$545***	***$582***
OPERATOR & LAND RETURN	$235	$279	$261	$248	$246

N Management, corn

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High Soil Productivity Rating Soils (SPR>136)

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What are we doing to facilitate practice change across the Midwest?

IL Corn
ilcorn.org

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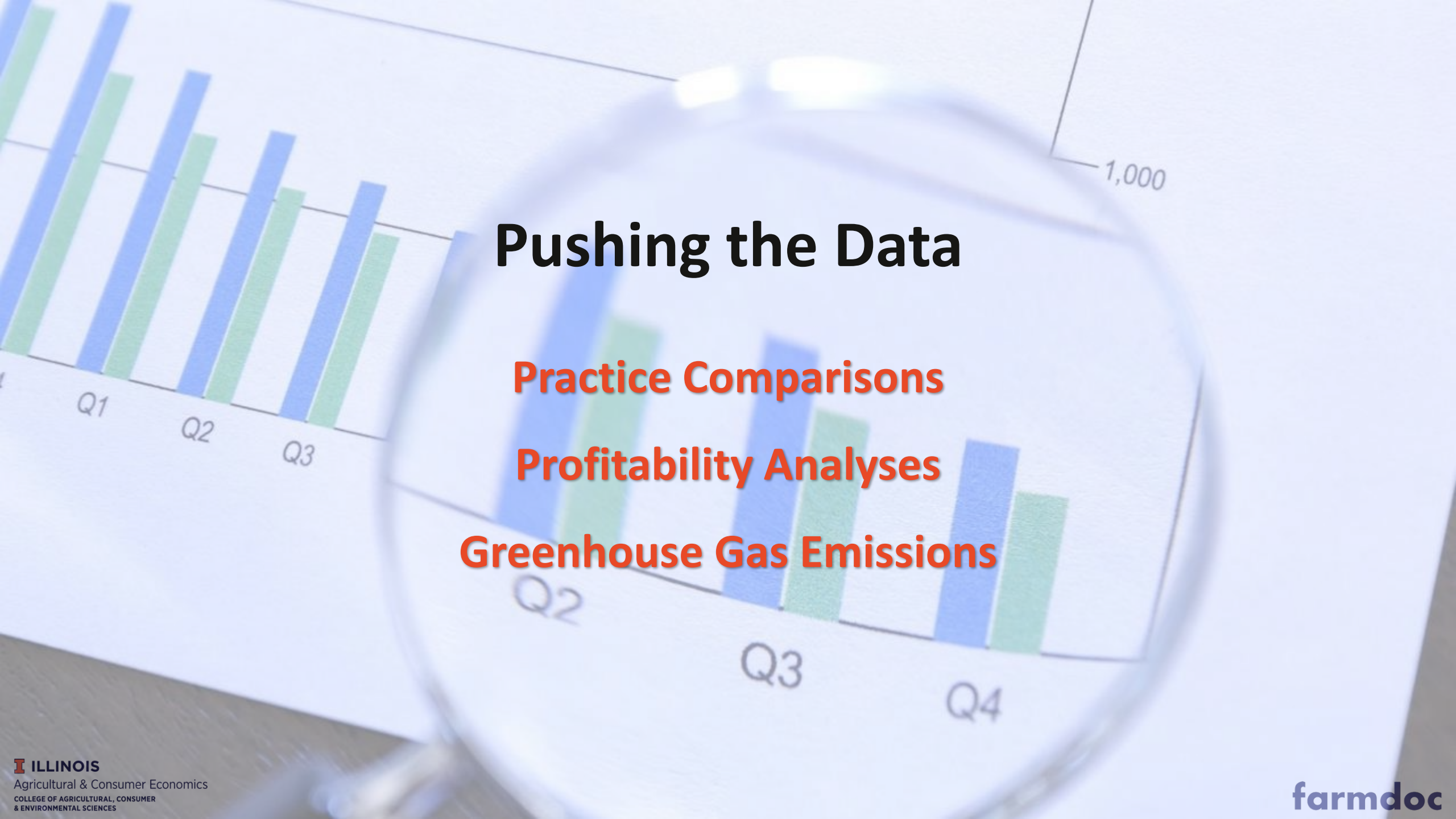


Pushing the Data

Practice Comparisons

Profitability Analyses

Greenhouse Gas Emissions

How do you expect per acre nitrogen rates used by Illinois farmers to change in the next five year?

- ○ I expect nitrogen rates to decrease
- ○ I expect per acre nitrogen rates to remain the same
- ○ I expect per acre nitrogen rates to increase
- ○ I don’t know

Nitrogen: Applications at (Maximum Return to Nitrogen) MRTN Rates

Have Highest Returns

Nitrogen Recommendations

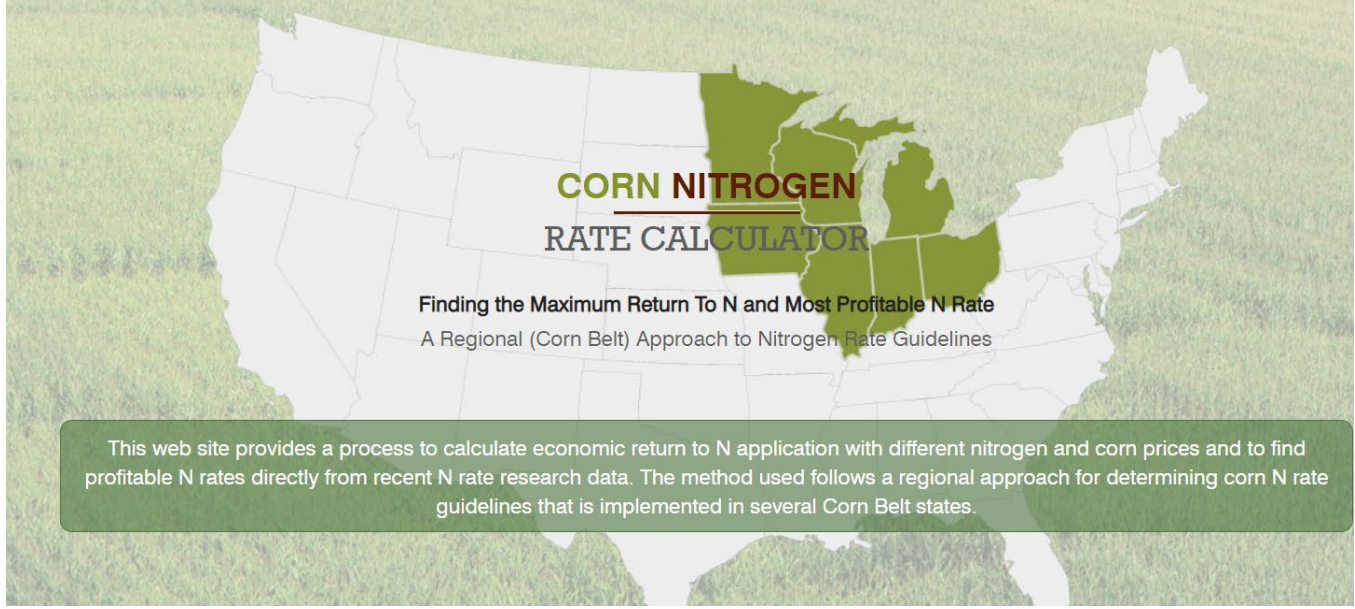


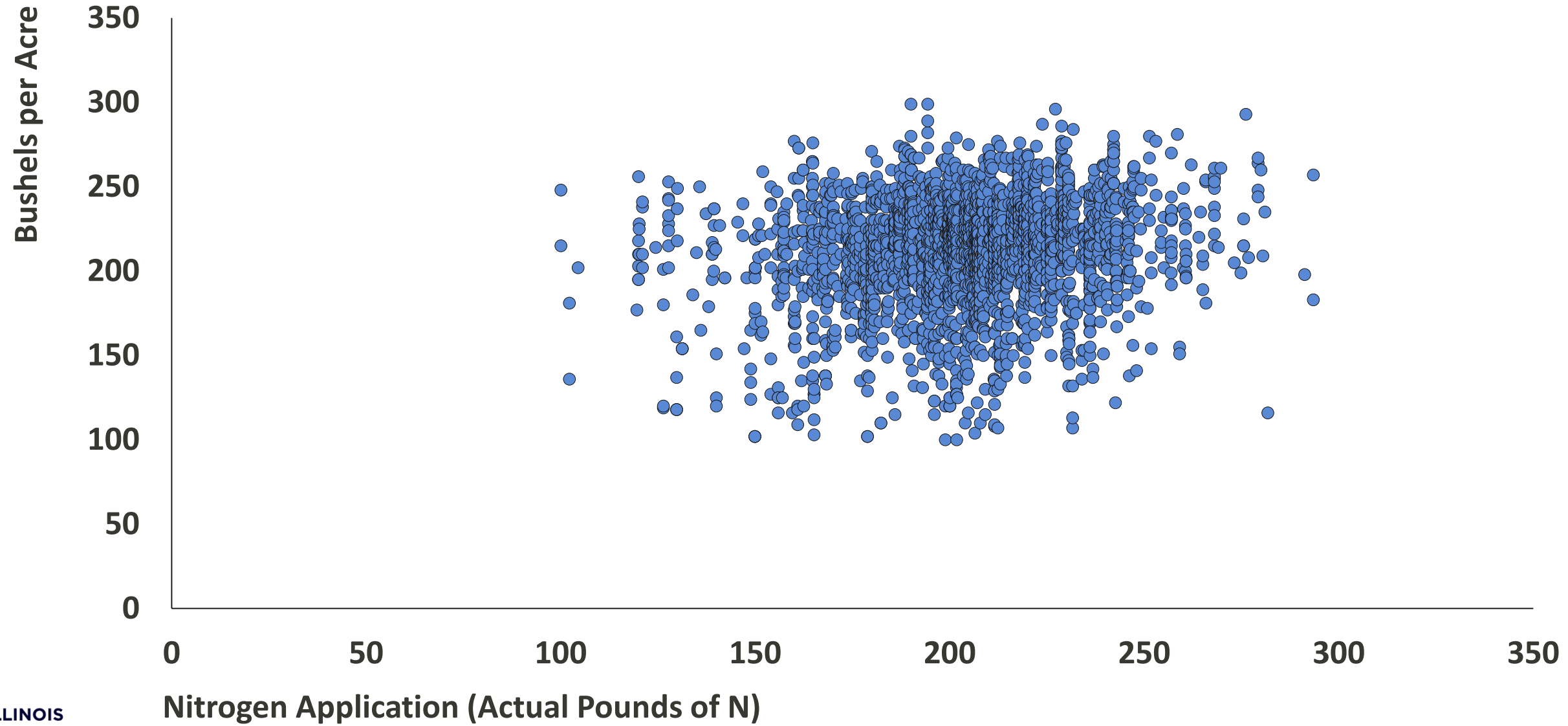
Table 1. Maximum Return to Nitrogen (MRTN) Rates in Pounds of N Applied, 2019[1,2]

	Corn-following-soybeans		Corn-following-corn	
Region of Illinois	Anhydrous Ammonia	28% Nitrogen Solution	Anhydrous Ammonia	28% Nitrogen Solution
	lbs./acre	lbs/acre	lbs/acre	lbs/acre
North	157	144	200	186
Central	174	163	200	188
South	180	166	193	180

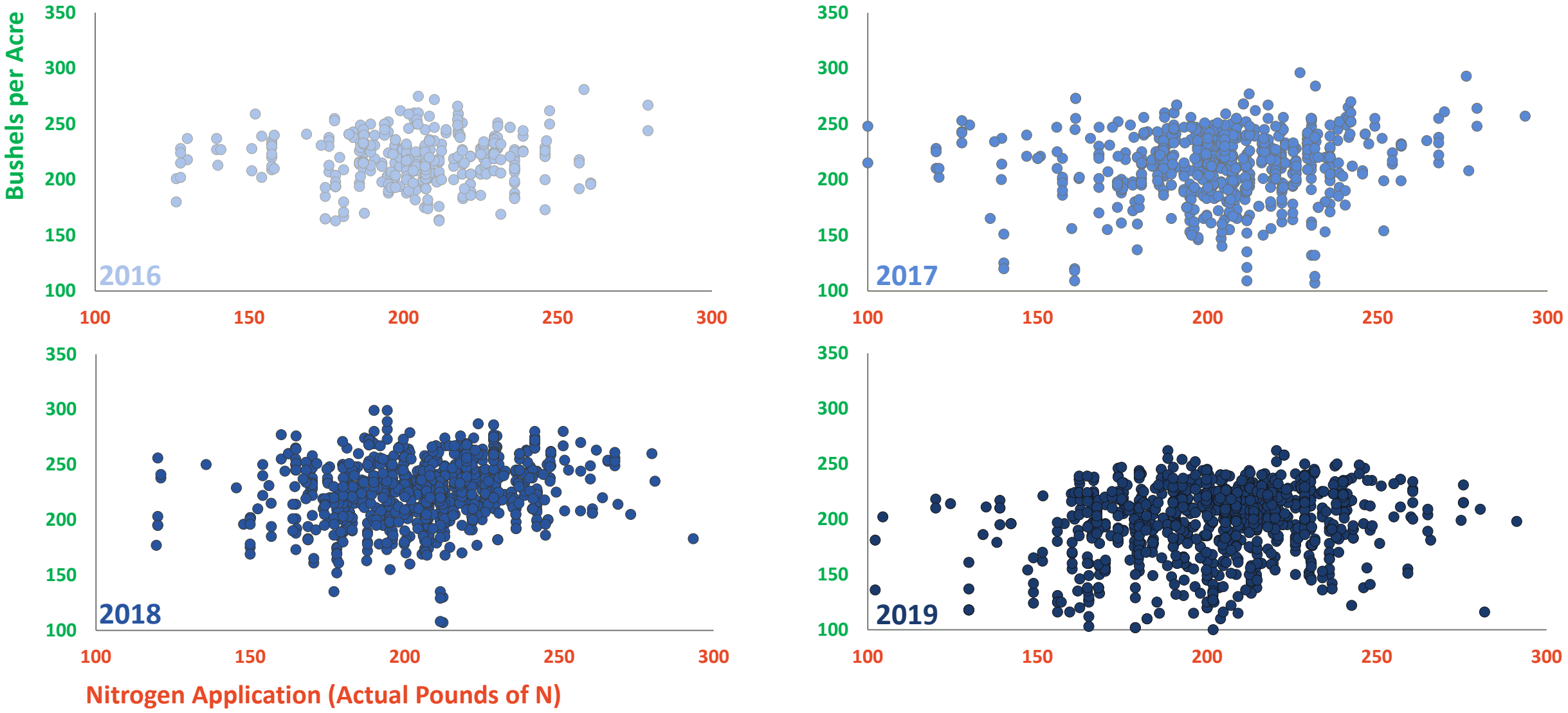
[1] Taken from the *Corn Nitrogen Rate Calculator (http://cnrc.agron.iastate.edu/) on March 18, 2019.*

[2] MRTNs determined with a $3.70 corn price, $615 anhydrous ammonia price, and a $280 nitrogen solution price.

Nitrogen Applications and Yields, 2015 to 2019



Nitrogen Applications and Yields, PCM, By Year



Divide Field Observations into Categories

Category	Description	Year		
		All Years	2016	2019
Below MRTN		5%	5%	7%
MRTN	20 lbs +/- MRTN	28%	25%	38%
Above 1	1 to 20 lbs. above	34%	33%	31%
Above 2	21 to 40 lbs. above	22%	25%	17%
Above 3	41 to 60 lbs. above	8%	8%	5%
Above 4	> 60 lbs. above	3%	4%	2%

Paper by Sellers, Schnitkey, and Gentry, "Do Illinois Farmer Follow University-Based Nitrogen Recommendations", Select Paper at AAEA

Yield by MRTN Nitrogen Categories

Category	All Years	Year			
		2016	2017	2018	2019
	Bu per acre				
Below MRTN	-16*	-39*	-3*	-14*	-24*
MRTN					
Above 1	-1	12	-7*	-1	1
Above 2	6*	16*	-1	12*	7*
Above 3	7*	23*	4	10*	9*
Above 4	18*	44	25*	14*	12

*Indicates significant different at 5% levels from MRTN category after controlling for soil productivity

Returns by MRTN Nitrogen Categories

Category	All Years	Year			
		2016	2017	2018	2019
	$ per acre				
Below MRTN	-16	-100	12	-4	-32*
MRTN					
Above 1	-20*	26	-32*	-28*	-23*
Above 2	-21*	17	-39*	-7	-33*
Above 3	-31*	19	-35*	-32*	-31*
Above 4	-31*	78	0	-54*	-38*

* Indicates significant different at 5% levels from MRTN category controlling for soil productivity

Return is measured by Operator and Land Return

Nitrogen Applications

Nitrogen applications at MRTN rates (below 200 pounds of N) have statistically higher returns than higher application rates

For 2021, lowering rates will have return/financial implications

Tillage & Profitability: Corn & Soybean

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Corn Returns by Tillage Benchmark, 2016 to 2019

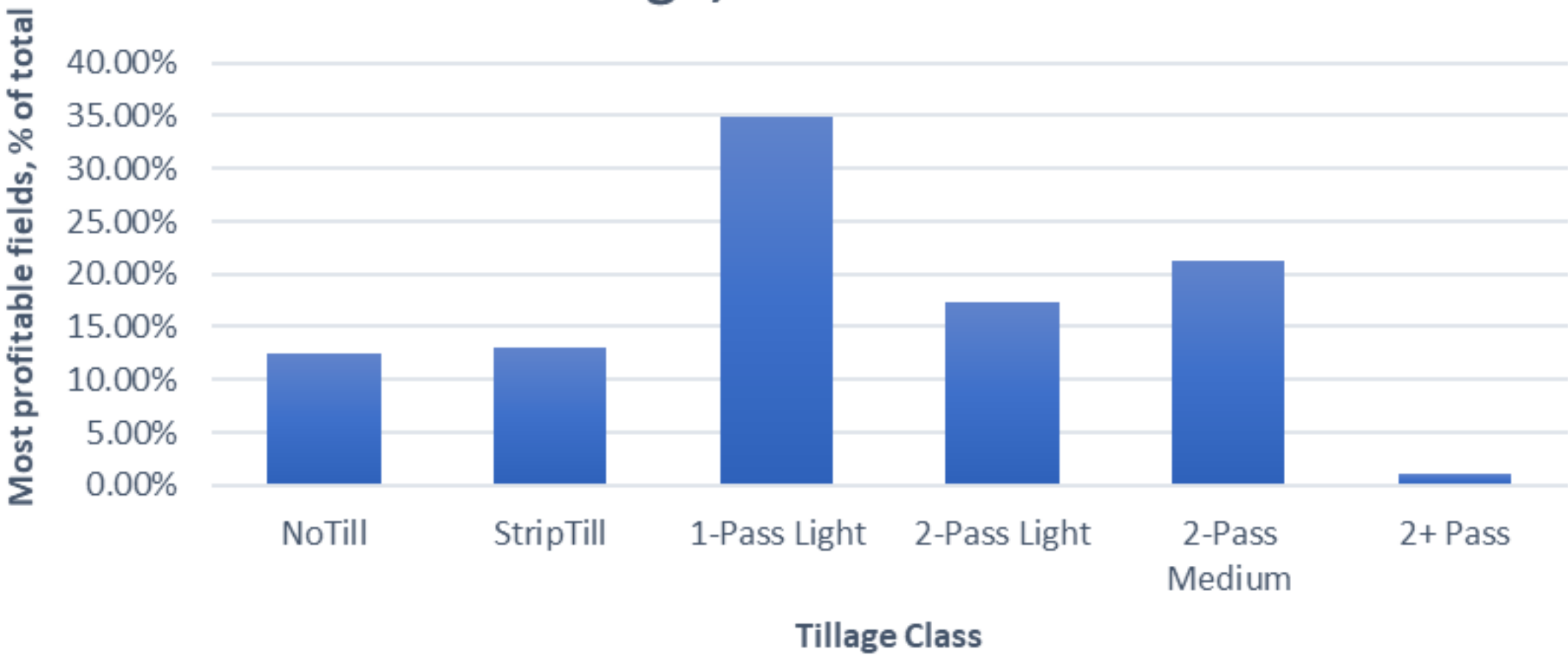
Tillage Benchmark	Yield Bu/Acre	Power Costs $/Acre	Return $/Acre
No-Till	209	$96	$229
Strip-Till	219	$114	$243
1-pass Light	220	$106	$266
2-Pass Light	224	$115	$269
2-Pass Moderate	223	$118	$250
2+ Passes	216	$135	$180

Return is operator and land return which equals gross revenue minus non-land costs

ALL PCM FIELDS 2015-2019

CORN, High SPR	NO-TILL	STRIP TILL	1-PASS LIGHT	2-PASS LIGHT	2-PASS MODERATE	2+ TILLAGE PASSES
2015-19 AVG VALUES						
# fields	*310*	*296*	*710*	*302*	*419*	*46*
Yield per acre	*209*	*219*	*220*	*224*	*223*	*216*
Soil Productivity Rating						
GROSS REVENUE	$750	$787	$790	$804	$801	$773
TOTAL DIRECT COSTS*	$388	$395	$382	$384	$396	$422
Field Work	$0	$20	$10	$22	$26	$38
Other power costs**	$96	$93	$96	$93	$92	$97
TOTAL POWER COSTS	$96	$113	$106	$115	$118	$135
OVERHEAD COSTS	$37	$37	$37	$37	$37	$37
TOTAL NON-LAND COSTS	$521	$544	$524	$536	$550	$594
OPERATOR & LAND RETURN	**$229**	**$243**	**$266**	**$269**	**$250**	**$180**

Top 25% Most Profitable Corn, High SPR Tillage, 2015-2019



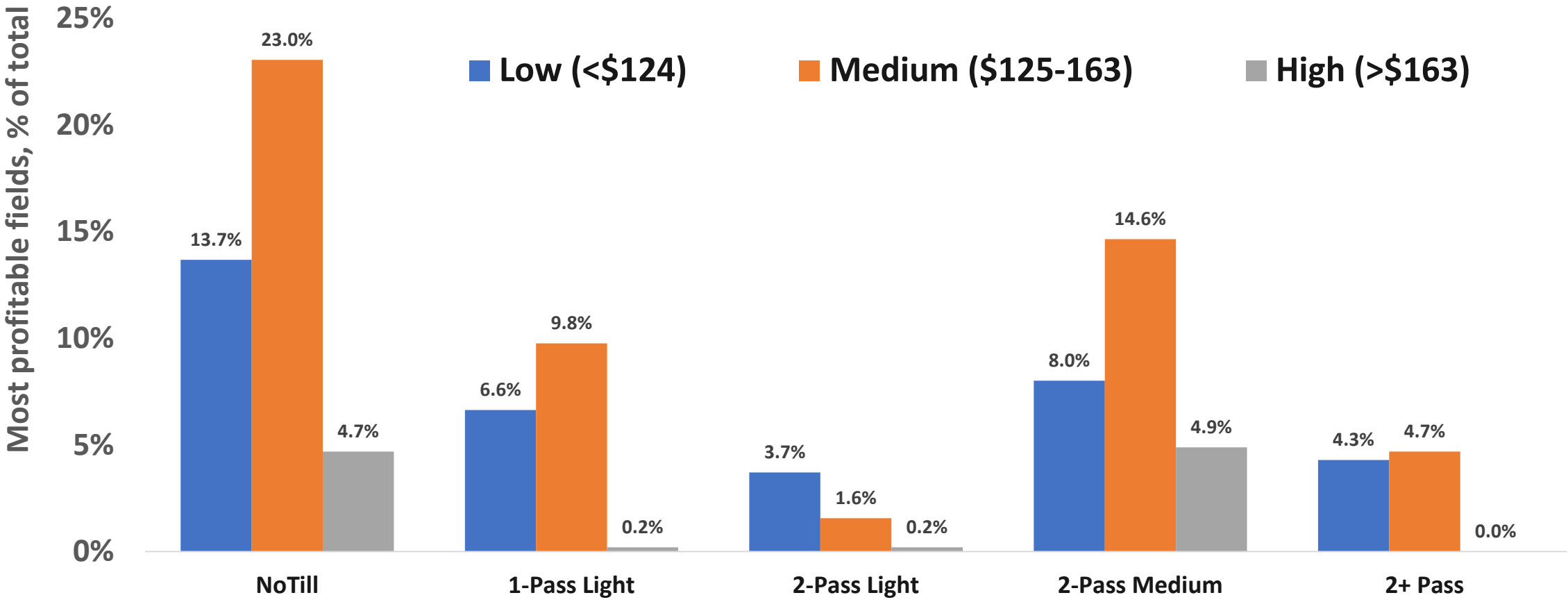
Soybean Returns by Tillage Benchmark, 2016 to 2019

Tillage Benchmark	Yield Bu/Acre	Power Costs $/Acre	Return $/Acre
No-Till	67	$72	$368
1-pass Light	70	$83	$387
2-pass Light	69	$87	$392
2-Pass Moderate	72	$84	$384
2+ Passes	68	$108	$357

Return is operator and land return which equals gross revenue minus non-land costs

Tillage & Profitability: Soybean

Top 25% Most Profitable for 2015-2019



Tillage

"**Moderate**" tillage levels have **higher returns** than more tillage

Consider when have to make machinery replacement decisions

In four years, how many acres will be in cover crops in Illinois?

- ○ Less than in 2020
- ○ About the same in 2020
- ○ I expect cover crops to grow about 10 to 20%
- ○ I expect cover corps to grow by more than 20%

Cover Crops: Lessons for New Adopters

Need to “experiment” with cover crops

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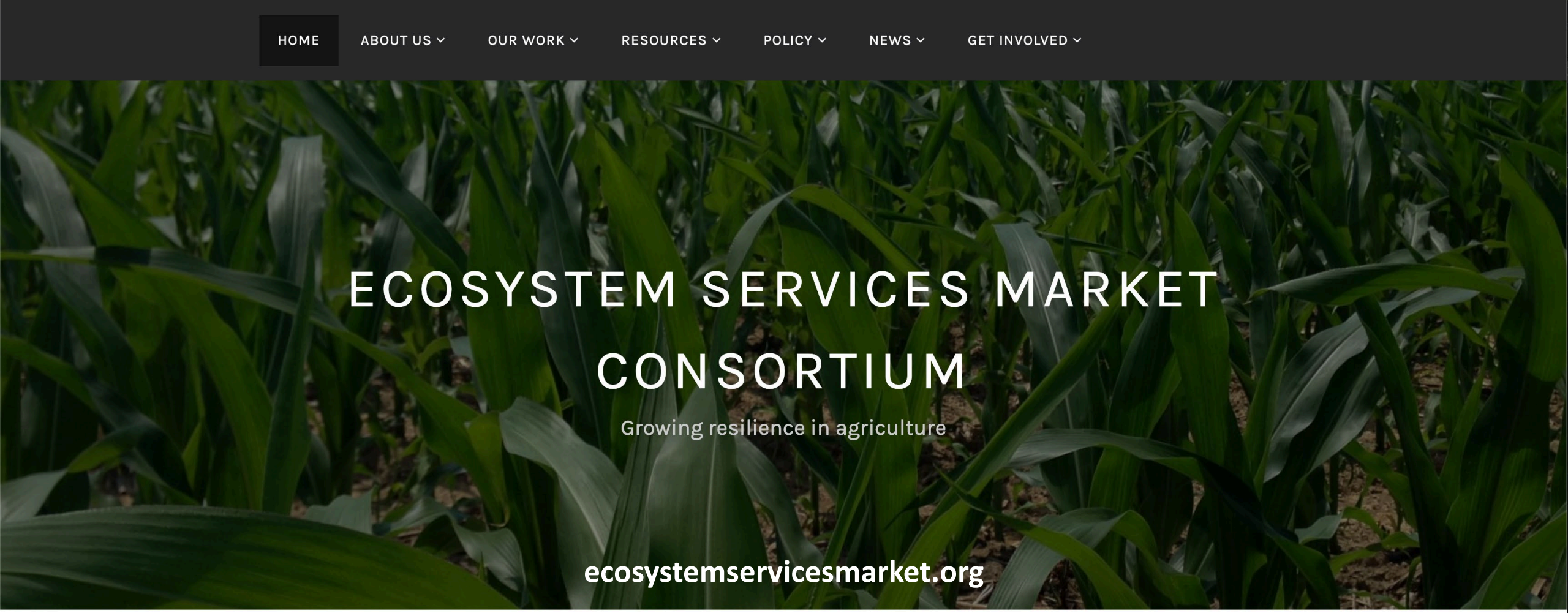
Cover Crop Benchmarks (2016 to 2019)

Cover crop	Soybeans			Corn		
	Yield Bu/Acre	Non-land Costs $/Acre	Return $/Acre	Yield Bu/Acre	Non-land Costs $/Acre	Return $/Acre
Overwintering	68	$280	$344	215	$553	$213
Winter Terminal	**68**	**$254**	**$371**	**217**	**$522**	**$258**
No cover crop	69	$257	$388	220	$536	$255
Count	253 overwintering 15 winter terminal 1,780 no cover crop fields			107 overwintering 49 winter terminal 1,960 no cover crop fields		



MISSION: To advance ecosystem service markets that incentivize farmers and ranchers to improve soil health systems that benefit society.

Launch a fully functioning national scale ecosystem services market conceived and designed to sell both carbon and water quality and quantity credits for the agriculture sector by 2022.

$14 Billion Dollar Industry – Annually

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Reducing CO2 Emissions by 8,155 Metric Tons

ILLINOIS FARMERS AND PEPSICO PARTNERED TO REDUCE CO2 EMISSIONS BY 8,155 METRIC TONS IN 2 YEARS

equals taking

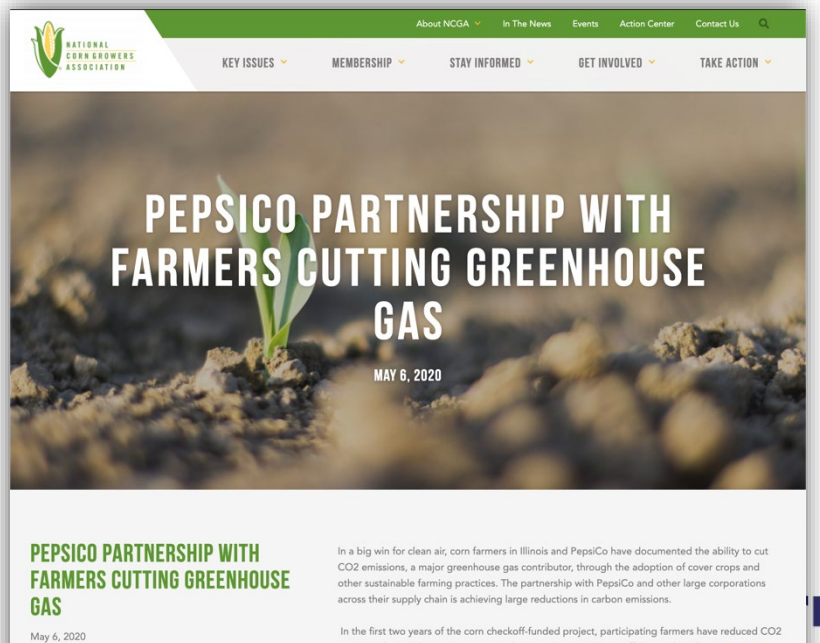
1,762

cars off the road

P | C | M

Precision Conservation Management

PCM-Pepsi Partnership providing cost share for cover crop production



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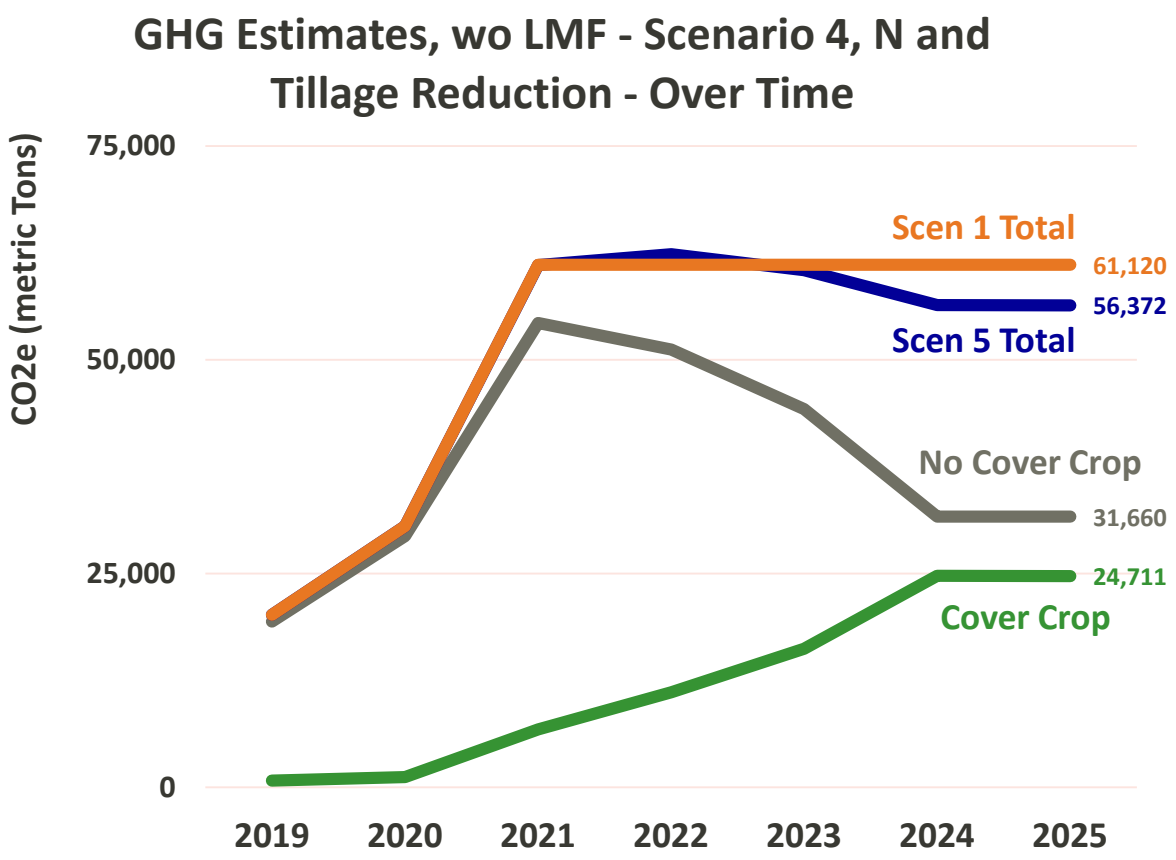
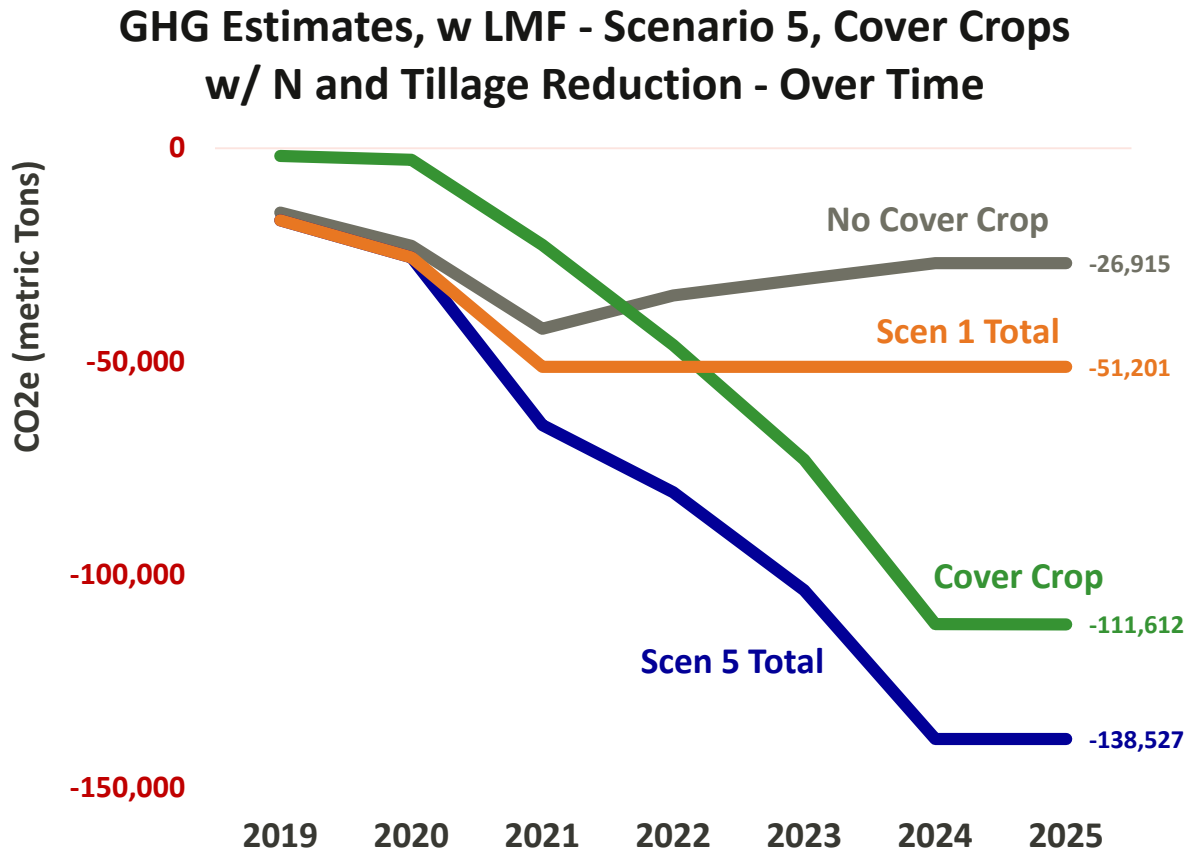
Conclusions: Scenario Analysis

Cover crops are the best single practice for GHG emissions reductions

Pairing cover crops with no-till and N rate reductions can reduce emissions by as much as 171%





Summary

1. MRTN most profitable nitrogen application rates
2. Appropriate tillage levels key to profitability
3. Cover crops have potential for returns in the future leading to need to experiment

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