Midwest Cropping Practices and the Environment

Gary Schnitkey

University of Illinois

Topics

1. Environmental overview
2. Tillage in Midwest
3. Nitrogen application
4. Cover crops

Environment and Midwest Agriculture

Past (and continuing) environmental concerns

1. Soil erosion
2. Pesticide runoff

Current environmental concerns

- Nutrient runoff (nitrogen and phosphorus)

Potential future environmental concerns

- Carbon release/sequestrations
- Energy balances
- Sustainability

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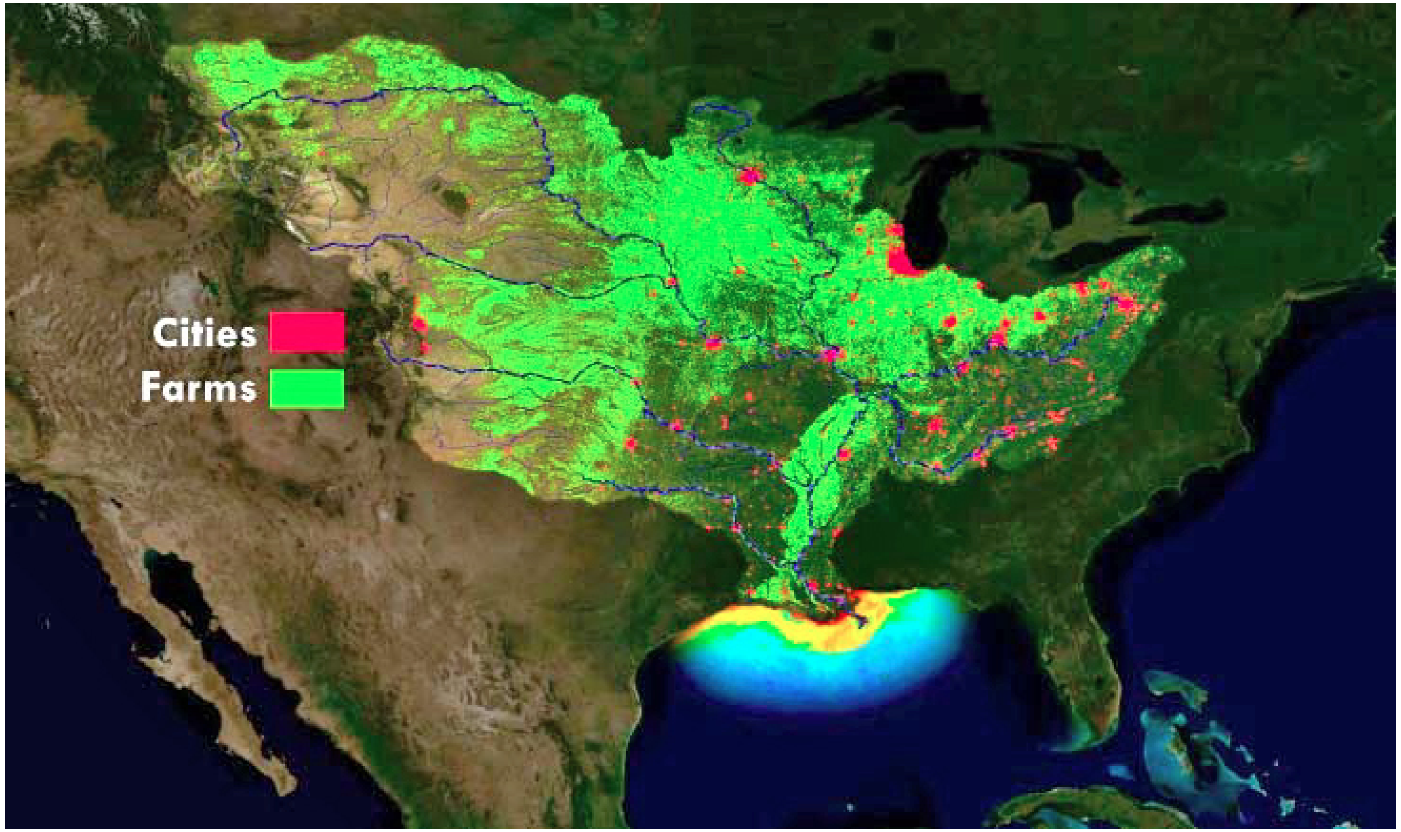
Nutrient Runoff

- Phosphorus
  - Lake Erie

- Nitrogen
  - Drinking water concerns
  - Gulf of Mexico (Hypoxia zone)



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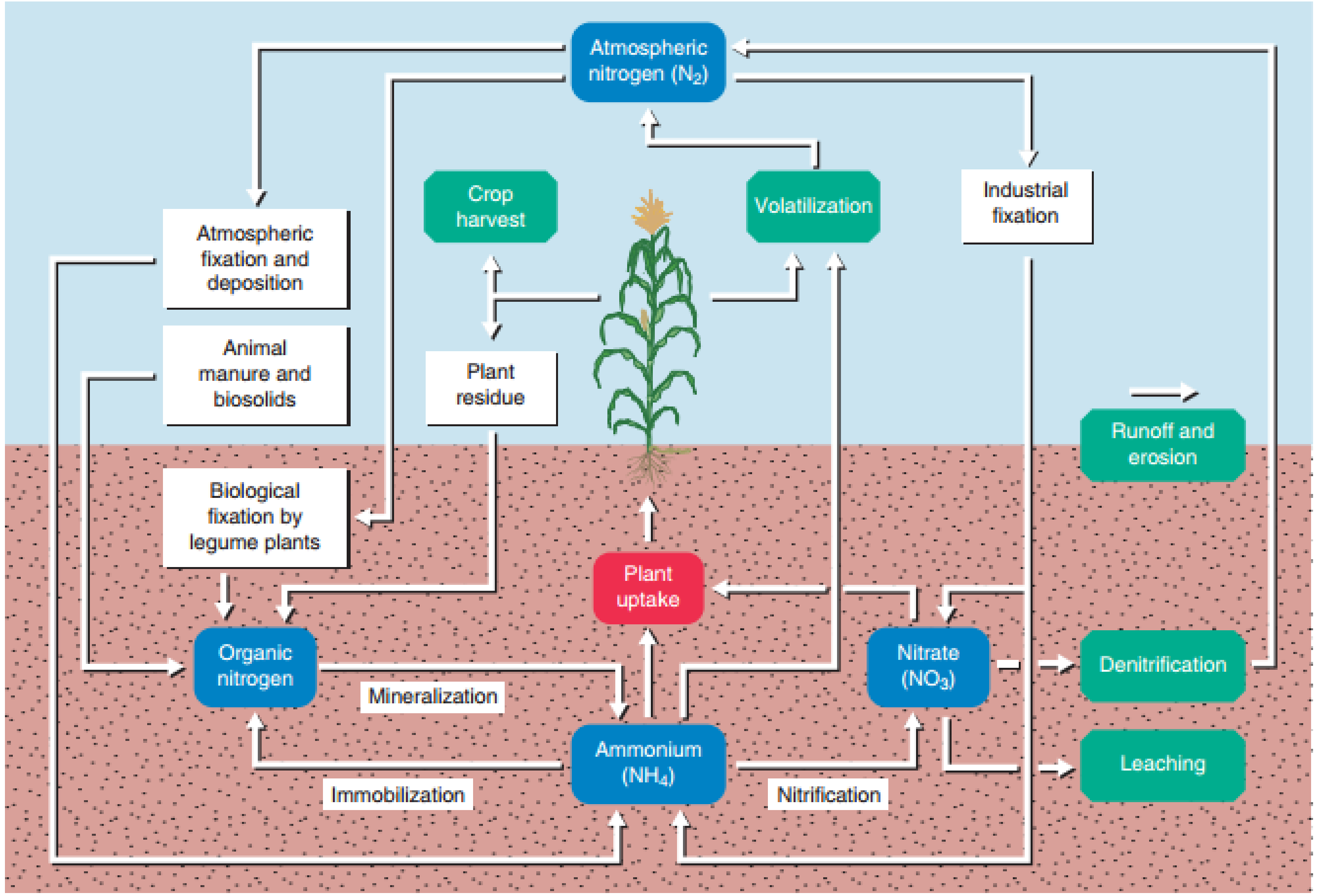
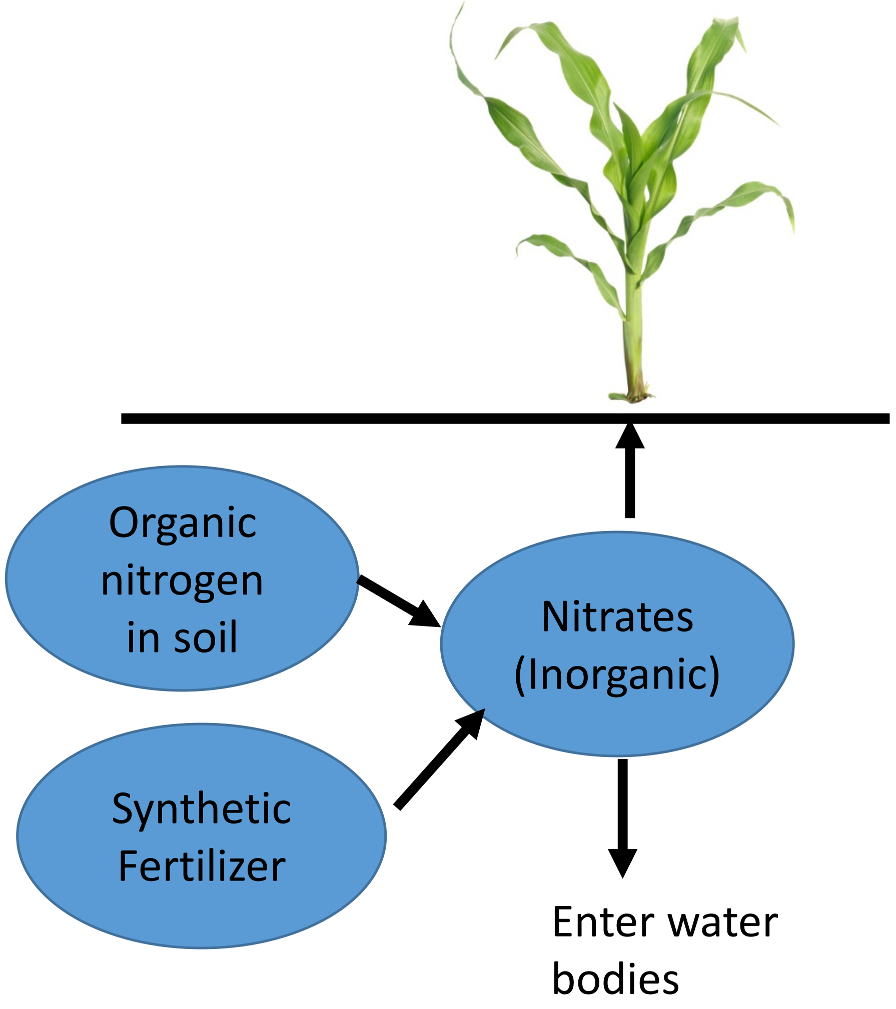
Nitrogen Cycle (Illinois Agronomy Handbook)



Nitrogen Management

- Edge of field technologies – all costs no return

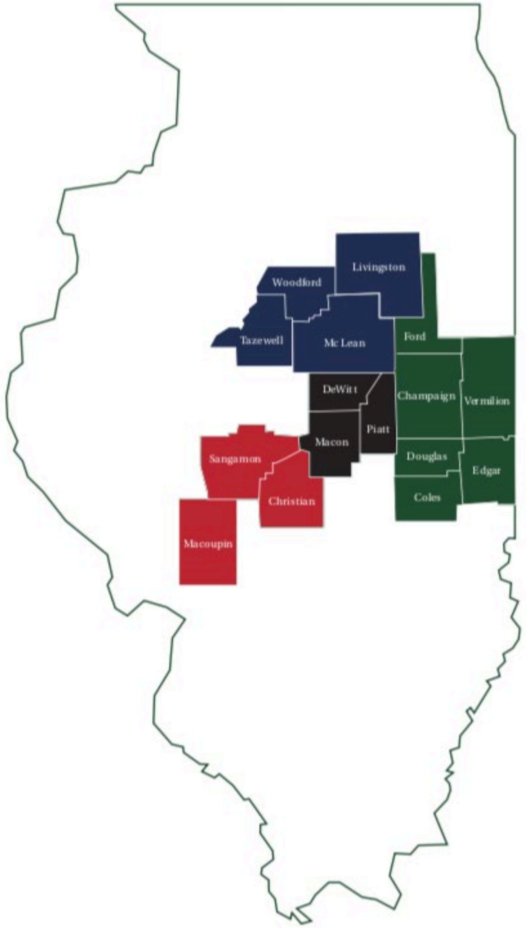
- Less tillage
- Nitrogen
  - Timing
  - Rate
  - Form
- Cover crops



Nitrate leaching largest concern in spring because:

1. Organic N converted to inorganic N
2. Nitrogen applications occur

PCM Results: Moving to an Advanced System



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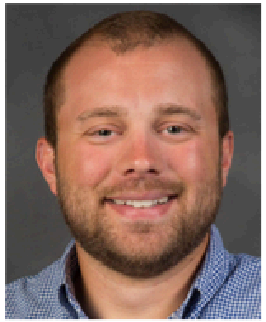
Dr. Laura Gentry's work focuses on watershed research to support agriculture water quality initiatives and nutrient management. She most recently served as research assistant professor at the University of Illinois at Urbana-Champaign, specializing in the sustainability of high-yielding corn production systems, residue management and reduced tillage, and production and sustainability of annual bioenergy crops. Previous to her position at UIUC, she was an assistant professor at North Dakota State University.

Her Ph.D. studies focused on the effect of tillage, rotation and organic amendments on nutrient cycling.



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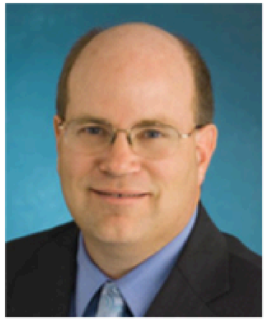
Mr. Travis Deppe leads IL Corn's water quality and sustainability initiatives focused on implementing the Illinois Nutrient Loss Reduction Strategy and meeting supply chain sustainability demands. In partnership with others, he develops and implements education, outreach and research to help Illinois corn farmers reach their nutrient loss goals and engage in the sustainability conversation. He most recently was the nutrient management project lead on GROWMARK's Sales Agronomy team. Earlier, as a research technician at Purdue University, he conducted and supported numerous research projects mostly focused on soil health and mitigating nitrogen losses via cover crop assimilation in varying crop production scenarios.



Dr. Gary Schnitkey

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Dr. Gary Schnitkey is a professor and farm management specialist in the Department of Agricultural & Consumer Economics, University of Illinois. His activities focus on farm management and risk management, including examination of issues impacting the profitability of grain farms such as corn-soybean rotations, machinery economics, and factors separating profitable from unprofitable farms. Schnitkey performed economic analysis for the Nutrient Loss Reduction Strategy and the economic analysis for conservation practices through the PCM program.

Results for

1) Tillage
2) Cover crop
3) Nitrogen management

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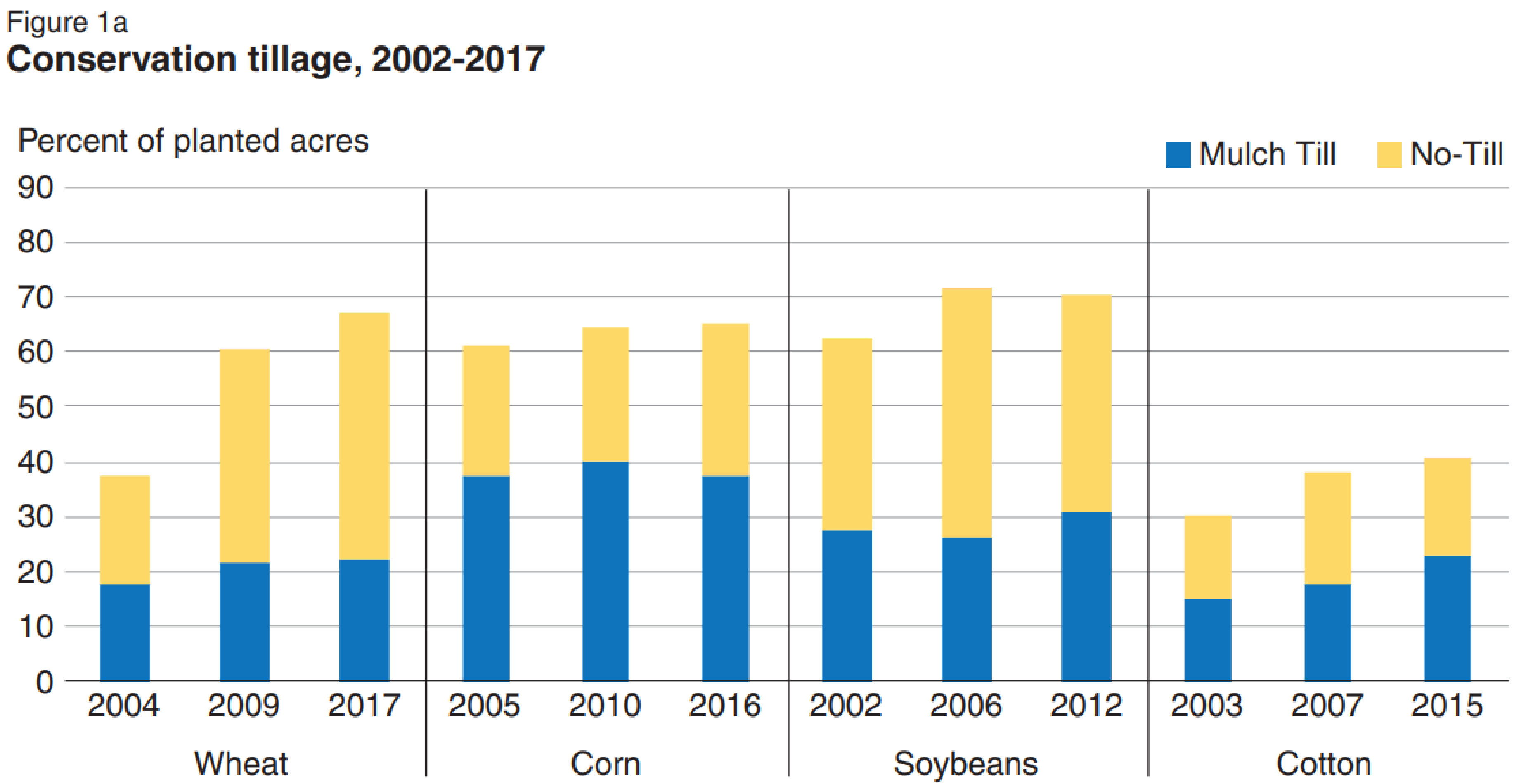


Source: Claassen, et al., *Tillage Intensity and Conservation Cropping in the US.* Economic Research Service, September 2018

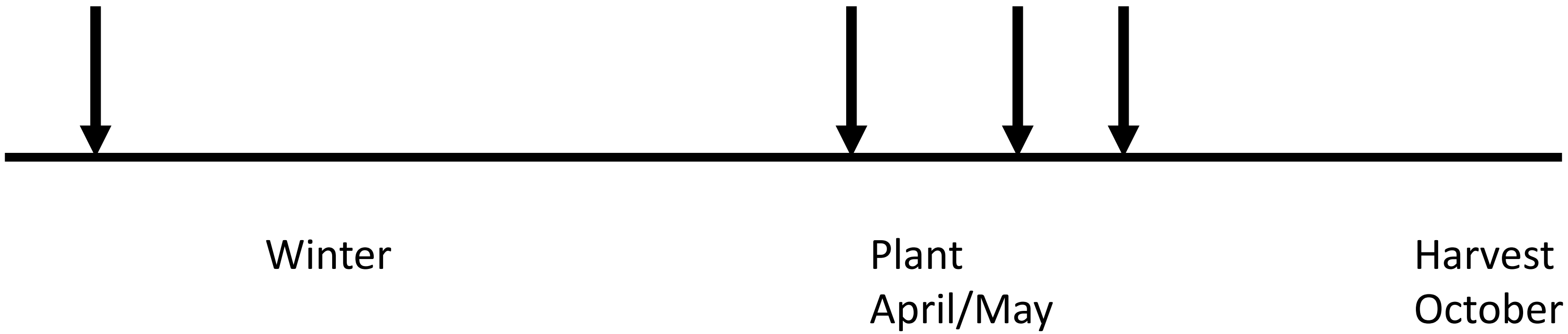
PCM Tillage Results for Corn, 2016 to 2018.

Tillage pass	Percent of Fields	Yield	Non-land Costs	Operator and Land Return
		bu/acre	$/acre	$/acre
No-till	15%	212	399	241
Strip Till	15%	221	429	256
1-pass	31%	216	496	259
2-pass light	12%	221	515	254
2-pass heavy	24%	216	518	234
2+ pass	2%	212	500	230

PCM Tillage Results for Soybeans, 2016 to 2018.

Tillage pass	Percent of Fields	Yield	Non-land Costs	Operator and Land Return
		bu/acre	$/acre	$/acre
No-till	45%	66	243	362
1-pass	13%	70	254	379
2-pass light	8%	65	234	366
2-pass heavy	17%	72	272	383
2+ pass	17%	65	261	334

Nitrogen Timing

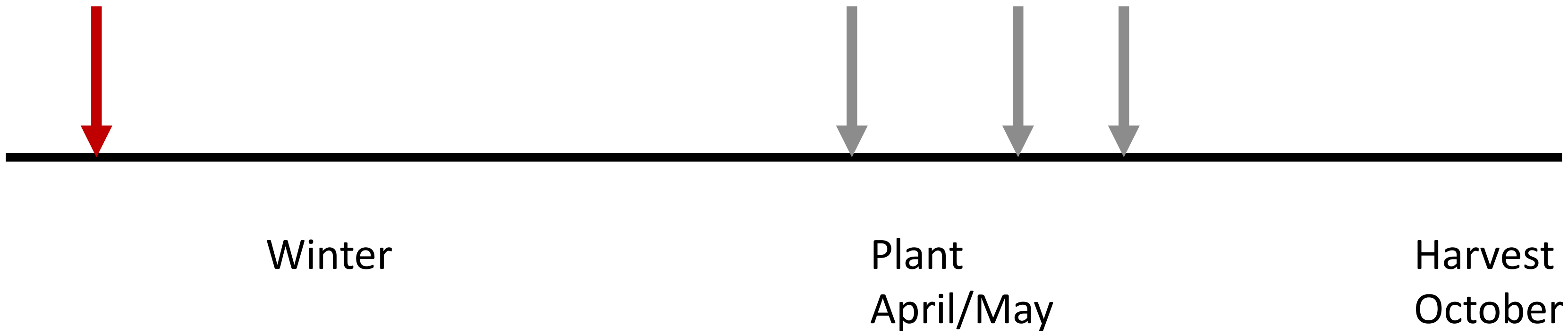


Nitrogen Timing

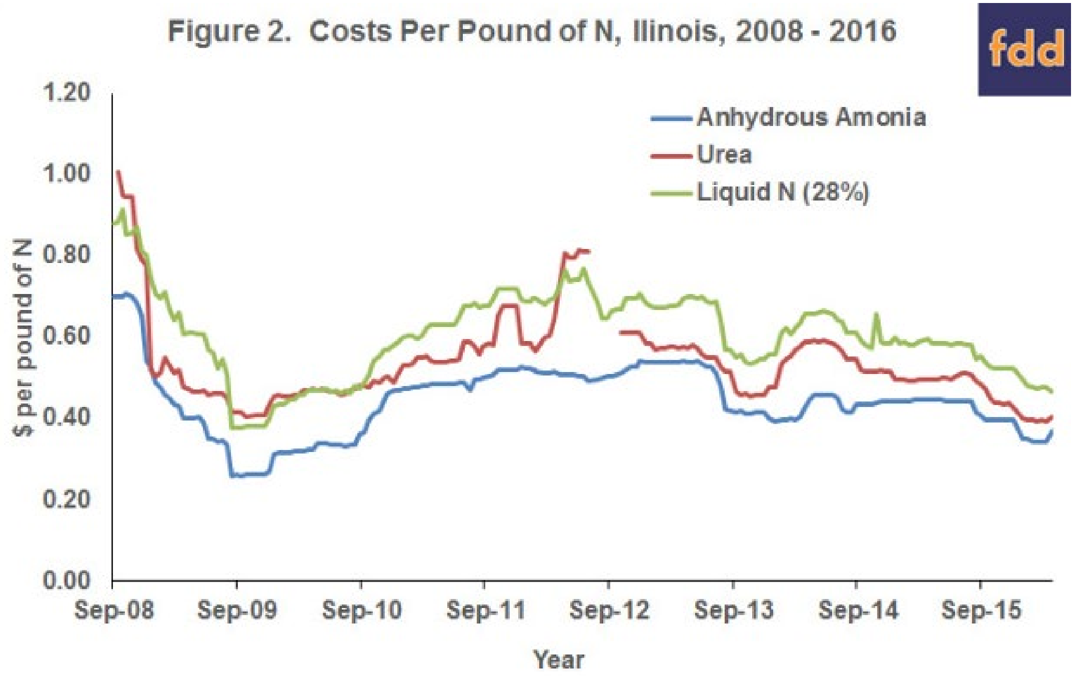
Fall anhydrous application

-- Put nitrogen on as anhydrous ammonia
-- Part of a strip till system (no-till modification)
-- Low cost nitrogen, but use nitrogen inhibitor

-- Increased chance of nitrogen effluent



Why Fall Applications?



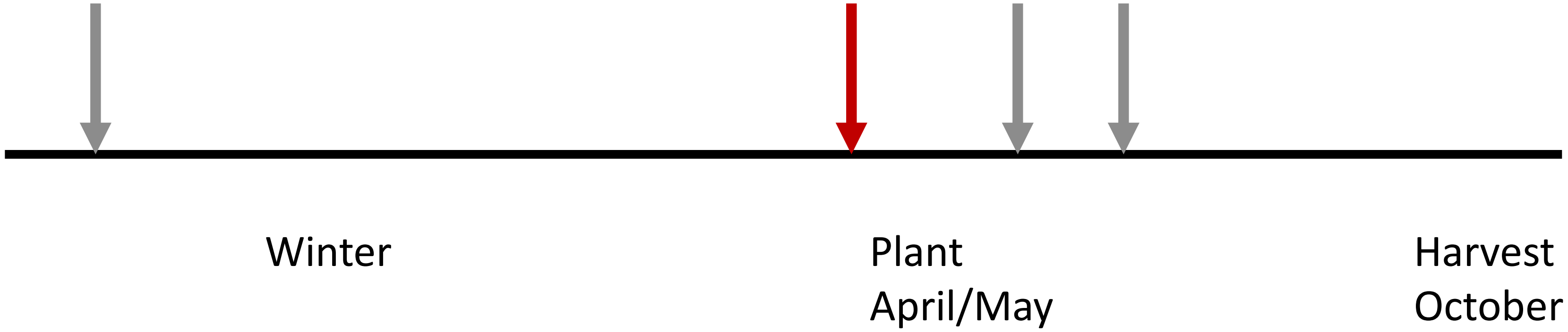
1. Very nice time of the year to apply, not 2018 or maybe 2019 (dry soil conditions, good field working conditions)
2. Time to do it (move application into more time constrained period when not in fall, retailers like it).
3. Use anhydrous ammonia (lowest cost way of applying N), but use a N inhibitor

Nitrogen Timing

Spring application (usually anhydrous)

-- Very short time frame
-- May or may not get it on (2019)
-- Require time between application and planting

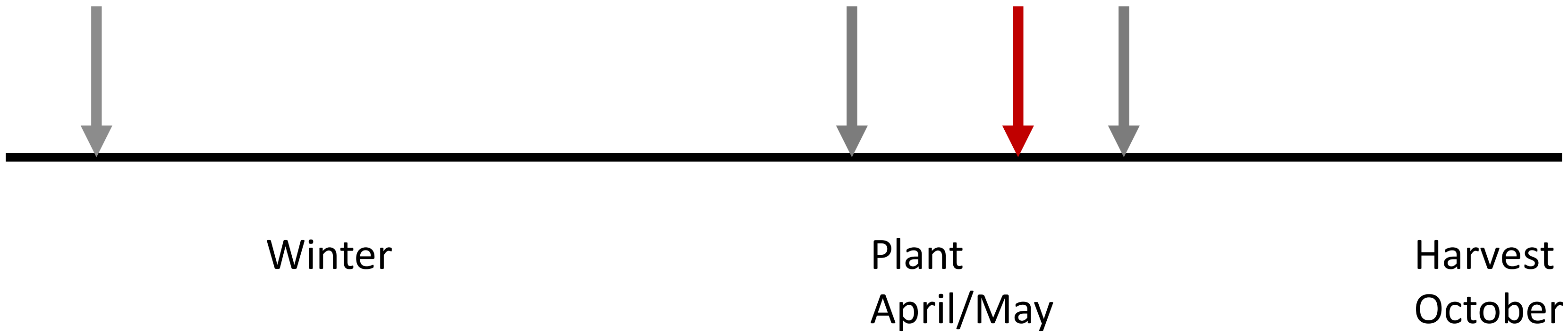
-- Somewhat reduced chance of nitrogen effluent



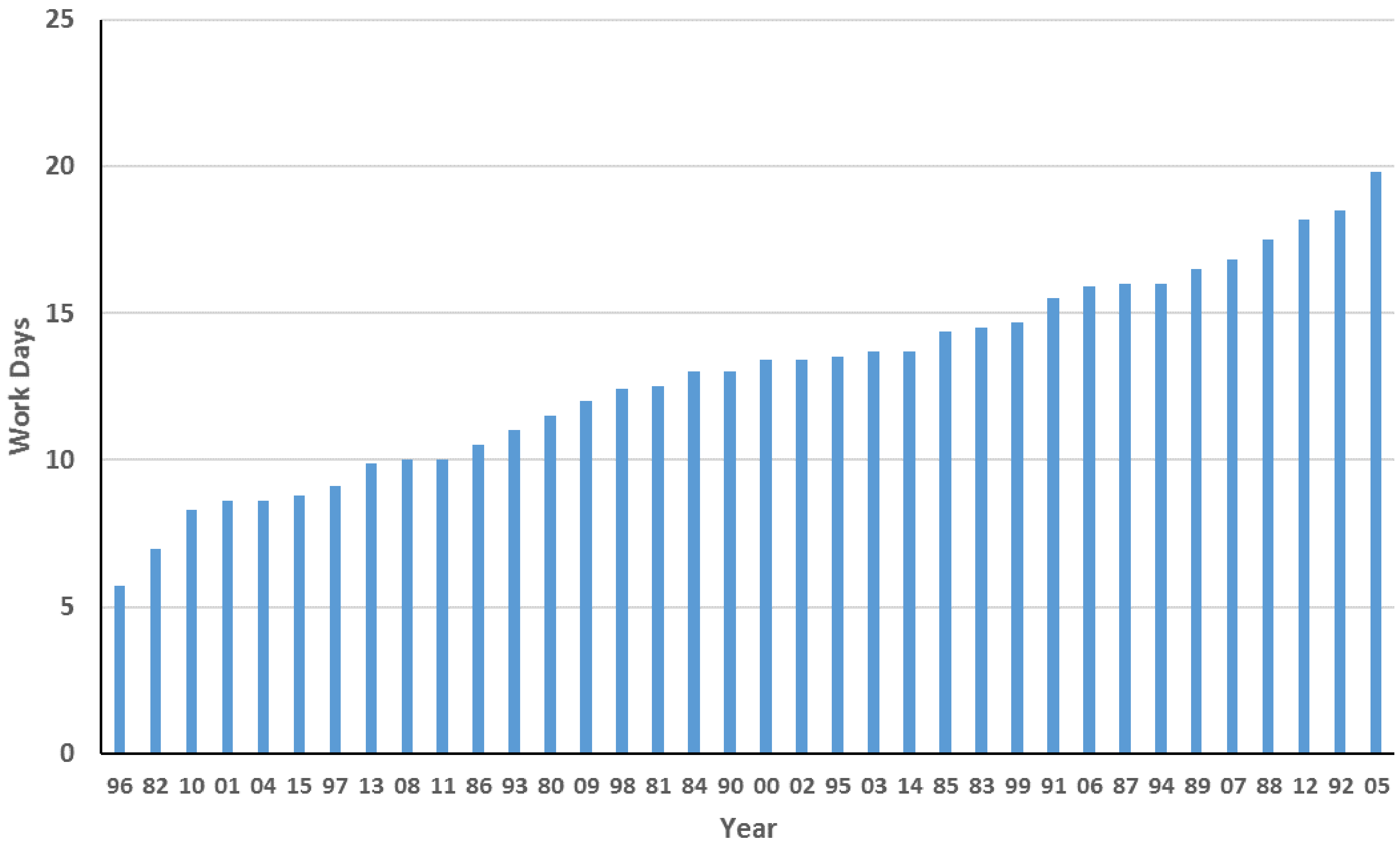
Post plant early (usually UAN)

-- More expensive nutrient form
-- Critical window opening
-- Need some nitrogen applied
   before planting

-- Reduced chance of nitrogen effluent



Work Days by Year, Central CRD, Illinois May 27 to June 15 (1980 through 2015)

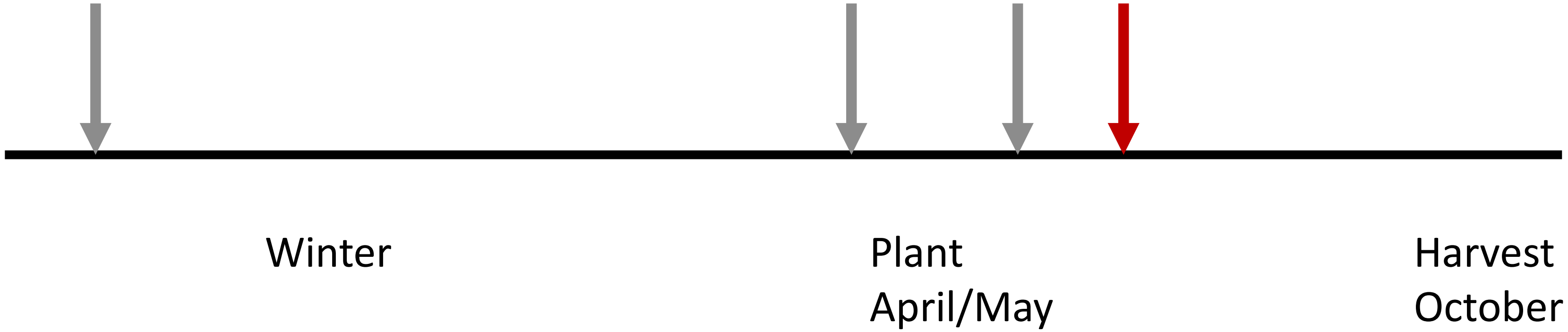


Nitrogen Timing

Late application (nitrogen solutions)

--Expensive way to put nitrogen on.
-- Very short working window
-- May be too late for corn

-- Reduced chance of nitrogen effluent (?)



Nitrogen Benchmark Classes, Corn, 2015-2018

N Benchmark Class	Percent of Fields	Operator and Land Return	Yield	Nitrogen Applied[1]	Average Nitrogen Cost	Average Nitrogen Cost per Lb
		$/acre	Bu/acre	lbs./acre	$/acre	$/Lb.
Mostly Fall	32%	$248	220	218	$76	$0.35
Mostly Pre-Planting	25%	$257	209	206	$67	$0.33
3-Way Split	3%	$274	225	216	$71	$0.33
50% Pre-Plant/50% Sidedress	11%	$245	216	204	$76	$0.36
Mostly Sidedress	26%	$253	213	199	$65	$0.32

[1] Pounds of actual nitrogen applied

Source: Precision Conservation Management

Source: farmdocDaily, November 12, 2019

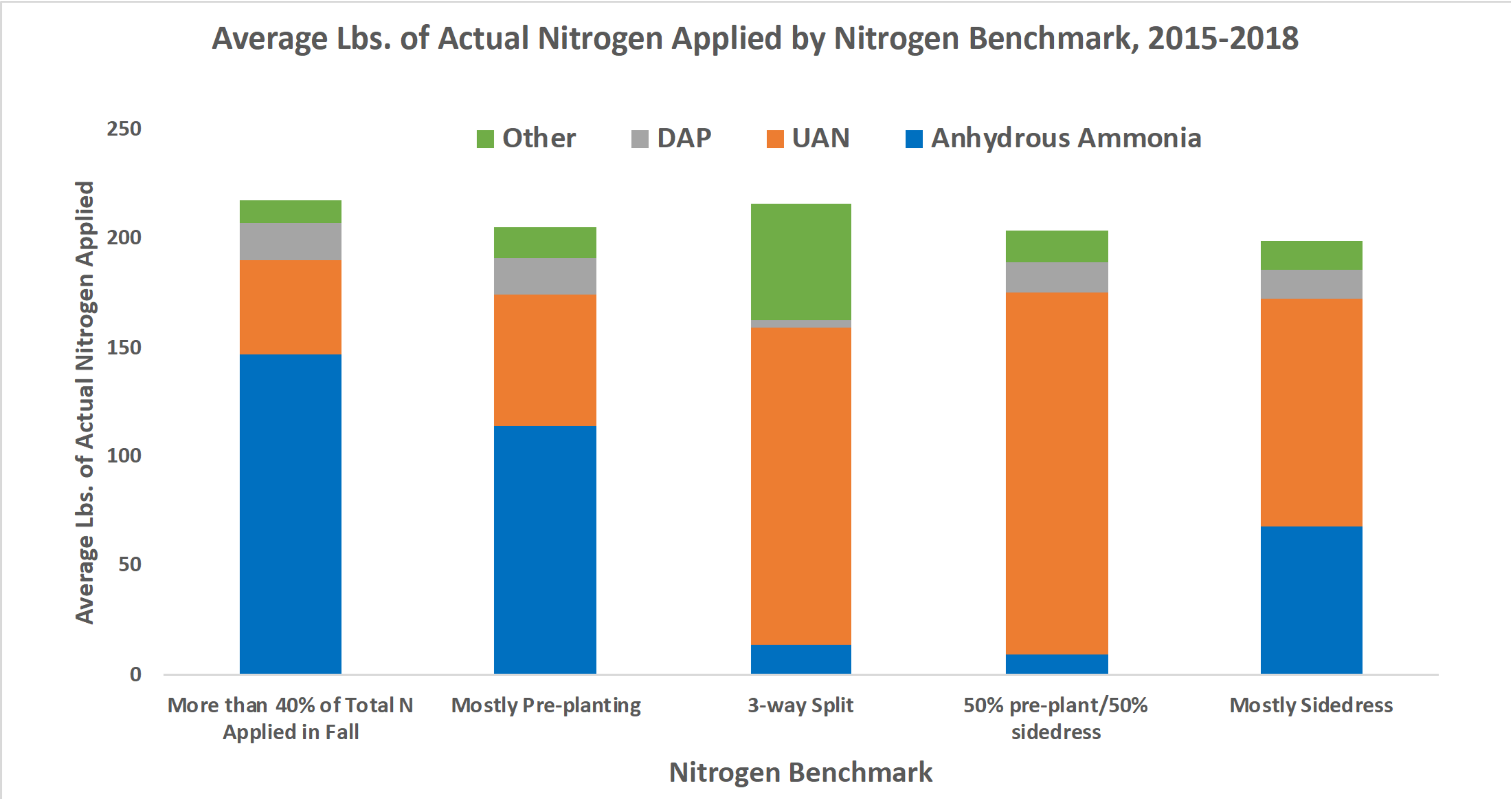
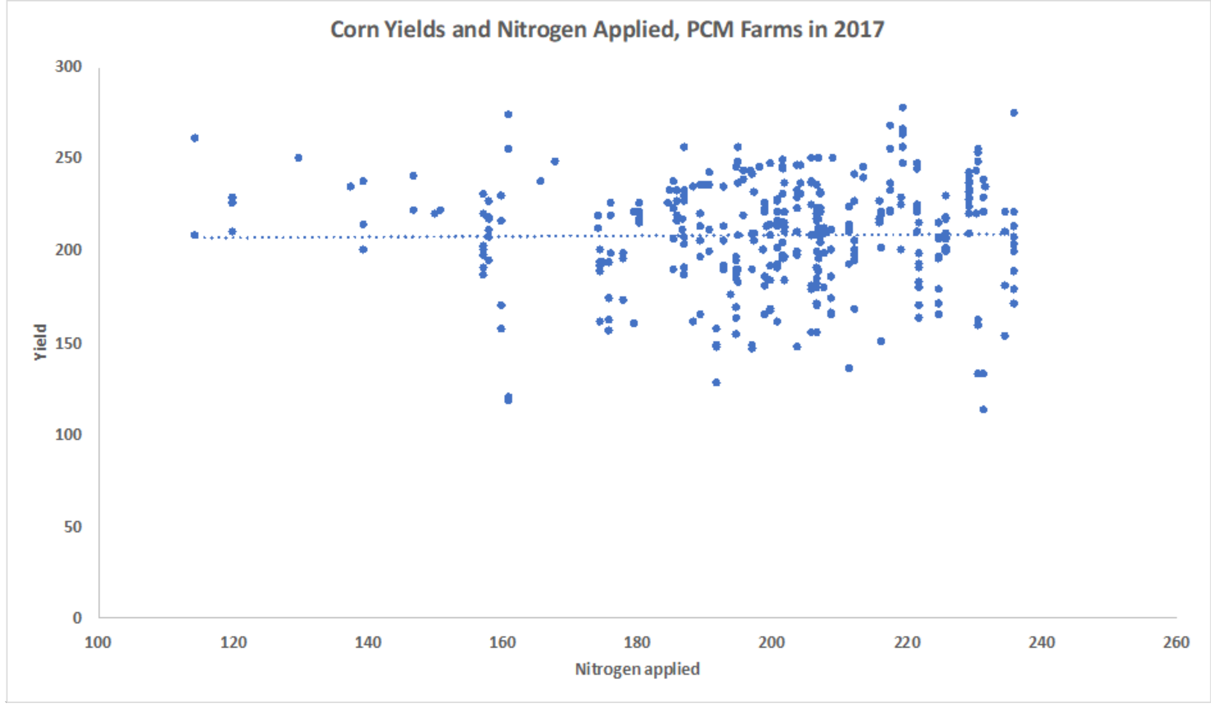

Average Lbs. of Actual Nitrogen Applied by Nitrogen Benchmark, 2015-2018
Other
DAP
UAN
Anhydrous Ammonia
Average Lbs. of Actual Nitrogen Applied
250
200
150
100
50
0
More than 40% of Total N Applied in Fall
Mostly Pre-planting
3-way Split
50% pre-plant/50% sidedress
Mostly Sidedress
Nitrogen Benchmark

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

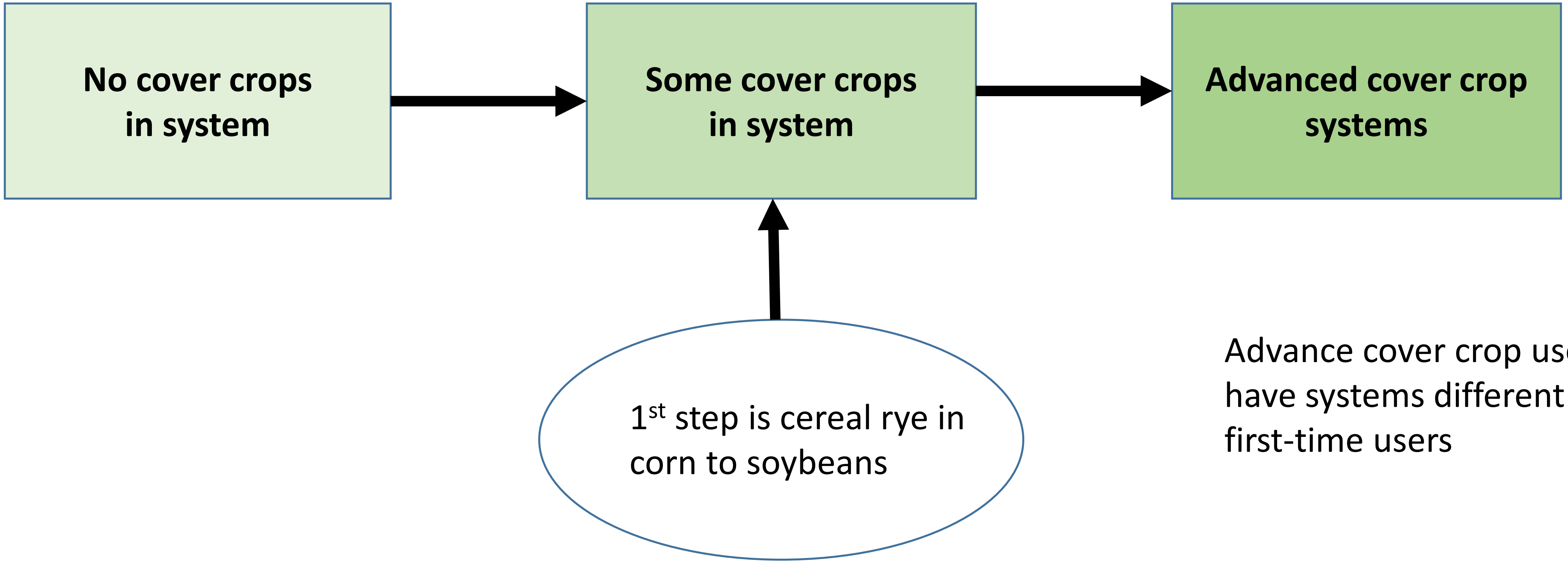
Region of Illinois	Corn-following-soybeans: Anhydrous Ammonia	Corn-following-soybeans: 28% Nitrogen Solution	Corn-following-corn: Anhydrous Ammonia	Corn-following-corn: 28% Nitrogen Solution
	lbs./acre	lbs/acre	lbs/acre	lbs/acre
North	157	144	200	186
Central	174	163	200	188
South	180	166	193	180

[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.



Cover Crops



Advance cover crop users have systems different than first-time users

Cover crop benefits:

1. Reduce nitrogen enter water bodies
2. Long-term change in soil structure, with benefits in adverse, drought years

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Field Passes (cereal rye into corn to soybeans)

Cover Crop

1. Plant cover crop seed ($30 per acre)
2. Apply DAP
3. Spray per-plant
4. Plant
5. Spray post-plant
6. Apply fungicide
7. Harvest

Two pass

1. Apply DAP
2. Perform primary tillage ($16)
3. Spring tillage ($13)
4. Spray pre-plant
5. Plant
6. Spray post-plant
7. Apply fungicide
8. Harvest

Cover crop system has $1 more costs, but that is dependent on tillage.
Get a different comparison when looking at no-tillage soybeans.

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PCM Cover Crops for Corn to Soybeans, 2016 to 2018.

Tillage pass	Percent of Fields	Yield	Non-land Costs	Operator and Land Return
		bu/acre	$/acre	$/acre
Over-winter cover crop	10%	68	264	359
Winter terminal cover crop	1%	67	249	371
No cover crop	89%	67	247	369

Summary

- Diversity in systems currently in use
  - Tillage
  - Nitrogen practices

- Movement toward nitrogen practices with reduced nitrogen losses
  - Split/reduced applications
  - Lowering of rates

- Cover crops
  - Known environmental benefits
  - Less well-known economic benefits