Playing in the Fertilizer Band: How Can Strip-Till Perform on Your Acre?

Connor Sible and Jared Fender

Crop Physiology Laboratory
Department of Crop Sciences
University of Illinois Urbana-Champaign

Indiana CCA Conference
December 9th, 2025

Crop Physiology

1

Physiology

2

Crop Physiology Laboratory Team – 2025

Professor and Research Professor
- Dr. Fred Below & Dr. Connor Sible

Principal Research Specialist
- Juliann Seebauer

Principal Research Specialist
- Jared Fender

Postdoctoral Research Associate
- Dr. Marli Favoretto

Ph.D. Student
- Sam Leskanich

Master's Students
- Gabriela Frigo Fernandes
- Ava Isaacs
- Derek Slifer
- Eric Morsink
- Wyatt Wessel

Visiting Research Scholars
- Renan Godoy de Marco
- Arthur Stasiak Jadoski
- Michel Bosmuller
- Lilian Gobel Kortstee

Crop Physiology

3

Crop Physiology Laboratory Team – 2025

Professor and Research Professor
- Dr. Fred Below & Dr. Connor Sible

Principal Research Specialist
- Juliann Seebauer

Principal Research Specialist
- Jared Fender

Postdoctoral Research Associate
- Dr. Marli Favoretto

Ph.D. Student
- Sam Leskanich

Master's Students
- Gabriela Frigo Fernandes
- Ava Isaacs
- Derek Slifer
- Eric Morsink
- Wyatt Wessel

Visiting Research Scholars
- Renan Godoy de Marco
- Arthur Stasiak Jadoski
- Michel Bosmuller
- Lilian Gobel Kortstee

Strip-Till Classroom #13

First Look: New Insights on Strip-Till Nutrient Use Efficiency, Placement & Timing

This is your chance to see initial findings from a brand-new strip-till research trial before anyone else. As a senior research specialist under Fred Below at the Univ. of Illinois, **Jared Fender** launched a massive strip-till trial in 2023 focusing on fertilizer placement, timing, utilization of different tillage methods, fall vs. spring fertility and more. With the Madison conference serving as the big reveal, Fender covers different management factors that can help optimize practices within your strip-till operation, including hybrid selection and nutrient availability.

You'll Learn: Strip-till insights gleaned from year 1 of the Univ. of Illinois Crop Physiology Lab's strip-till trial and how different placement methods alter nutrient availability within strip-till systems.

Jared Fender
Champaign, Ill.

Friday, August 9, 2024

Friday, August 1, 2025

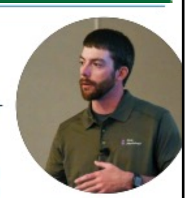
General Session:

Rethinking Strip-Till Assumptions with Brand-New Data

This is your chance to see the eye-opening findings from a new strip-till research trial — before anyone else! As a senior research specialist under Dr. Fred Below at the Univ. of Illinois, **Jared Fender** launched a massive strip-till trial in 2023 focusing on fertilizer placement, timing, different tillage methods, hybrid selection, fall vs. spring fertility and more.

After revealing initial takeaways at last year's conference, Fender returns with a comprehensive breakdown of new data analysis to help optimize your own strip-till operation for 2025 and beyond.

You'll Learn: Insights gleaned from the first full growing season of the Univ. of Illinois Crop Physiology Lab's strip-till trial, how strip-till affects the root architecture of certain hybrids, which hybrids are best suited for strip-till & how different placement methods alter nutrient availability.

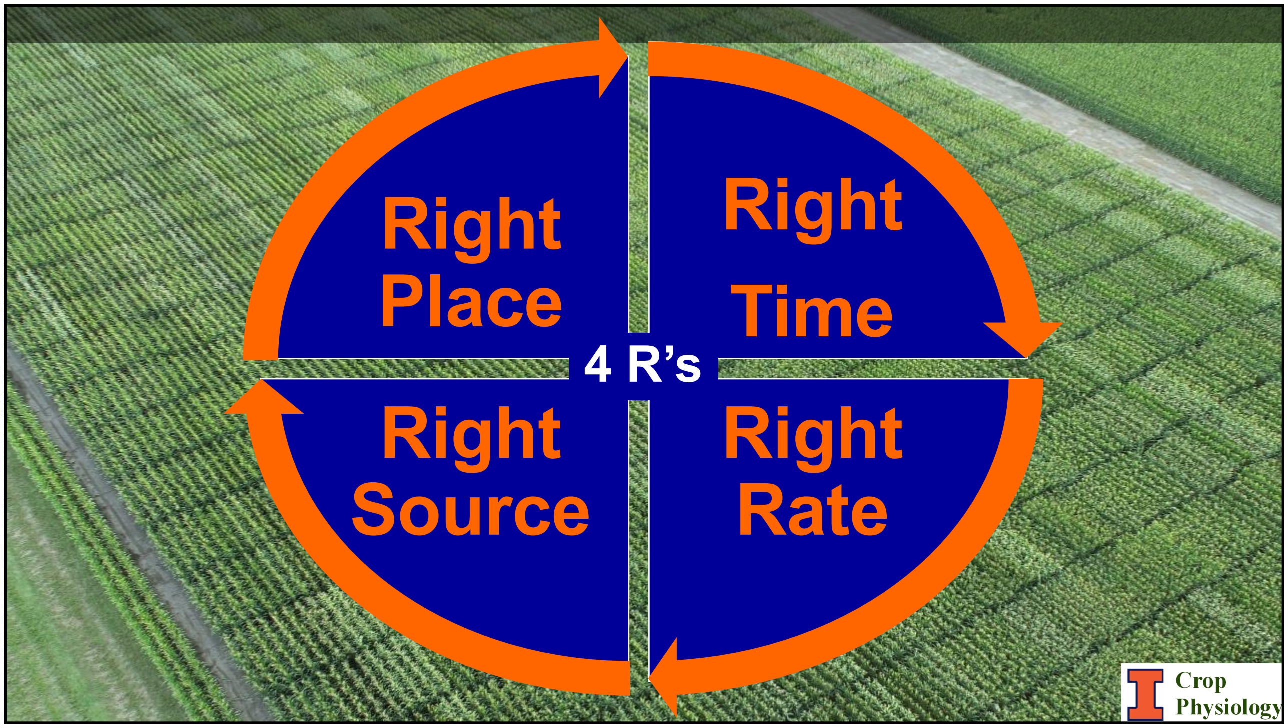


Jared Fender
Univ. of Illinois

Sponsored by: Calmer

Crop Physiology

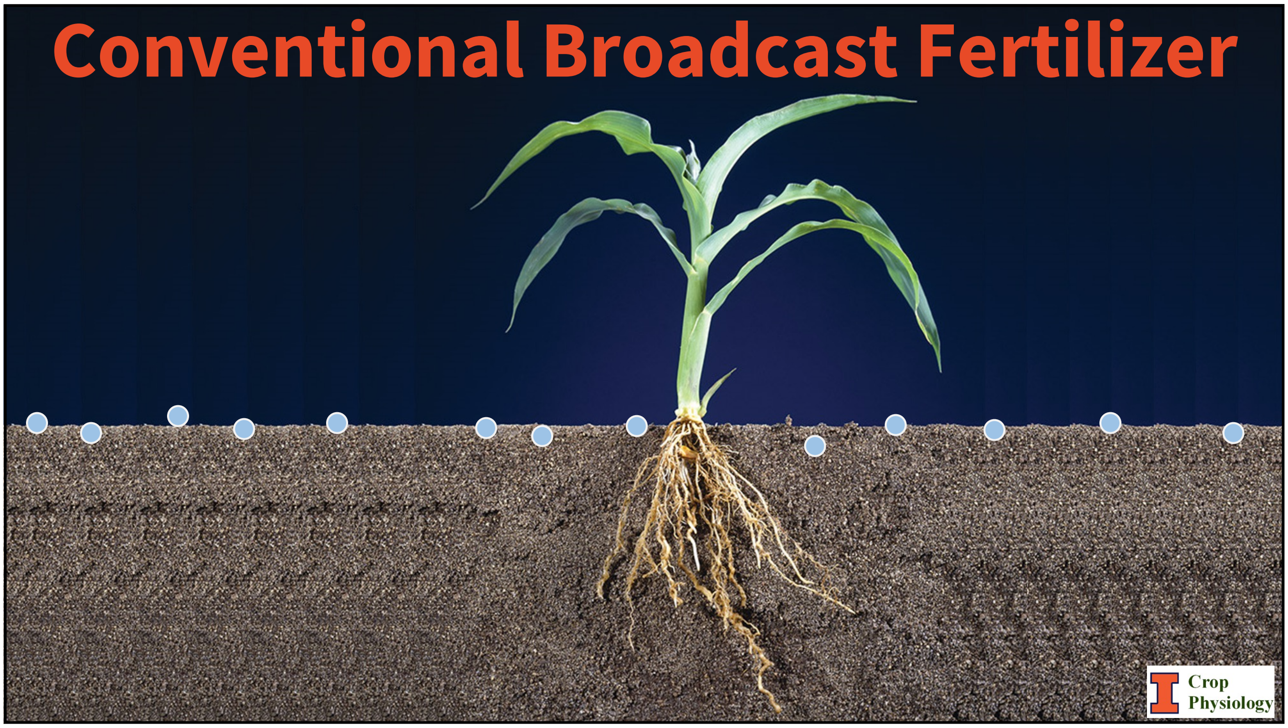
4


Right
Place
Right
Time
4 R's
Right
Source
Right
Rate
Crop
Physiology

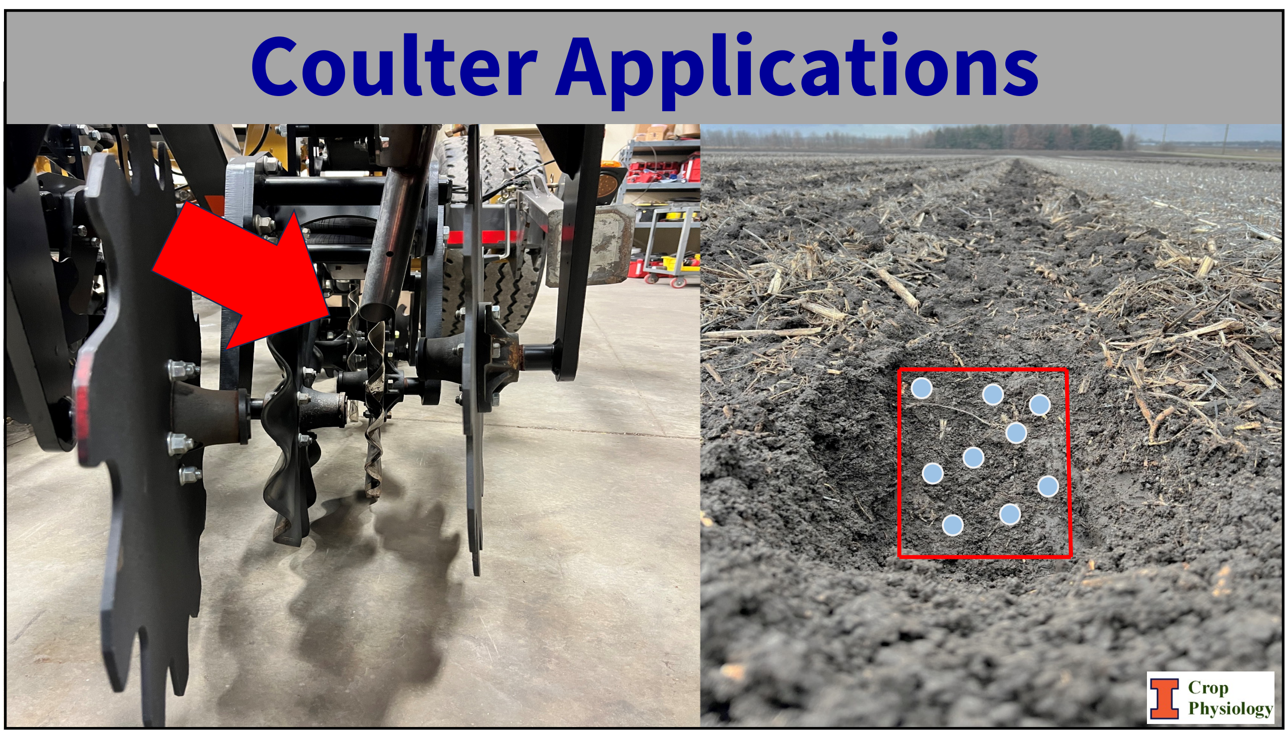
5


Broadcast Applications
GANDY
Crop
Physiology

6


Conventional Broadcast Fertilizer
Crop
Physiology

7


Coulter Applications
Crop
Physiology

8

Fertility Dispersed Within Tillage Width
0-6 inches Deep
Via Coulter

9

Shank Applications

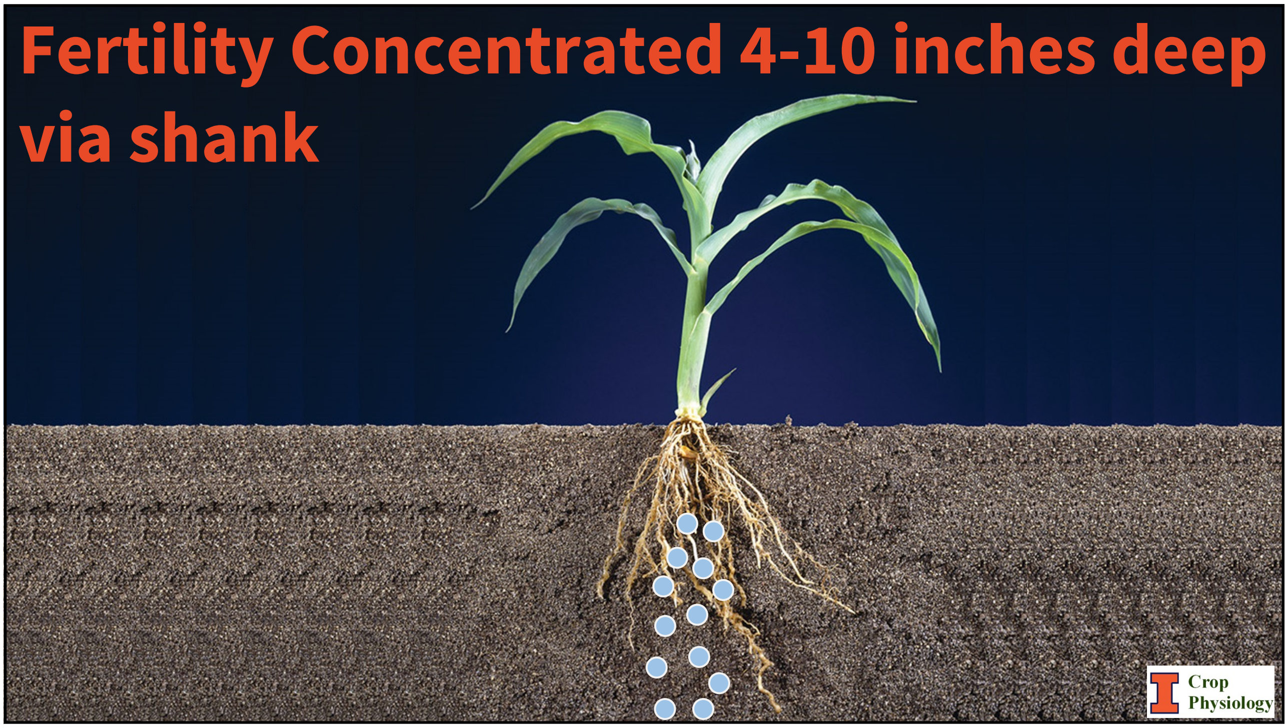
10

Fertility Concentrated – 8-10 inches deep via shank

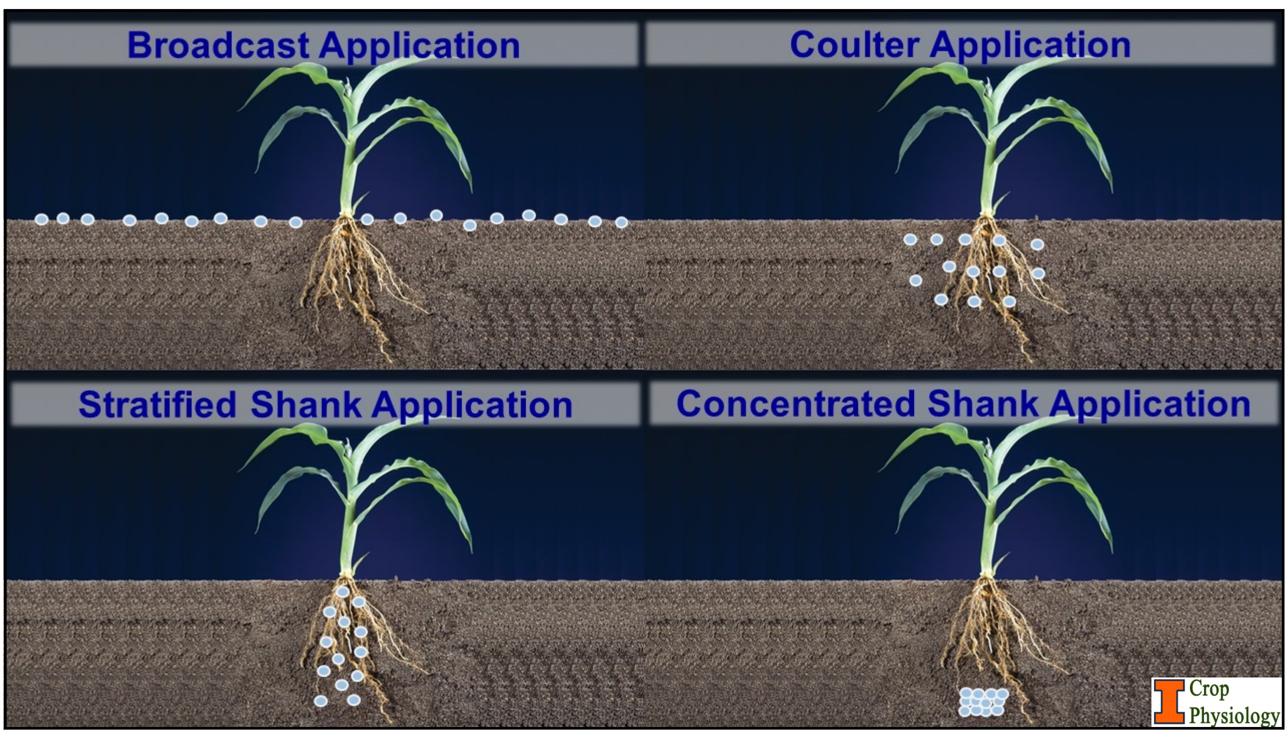
11

Shank Applications

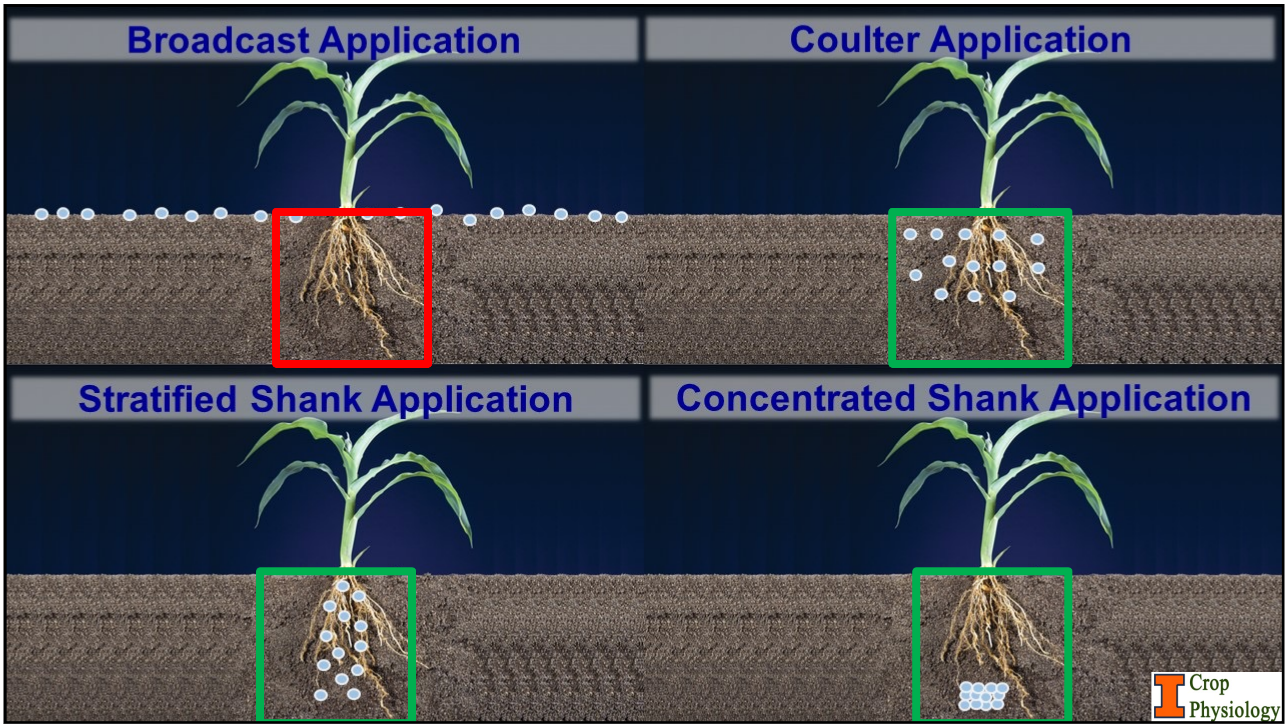
12


Fertility Concentrated 4-10 inches deep via shank
Crop Physiology

13


Broadcast Application
Coulter Application
Stratified Shank Application
Concentrated Shank Application
Crop Physiology

14



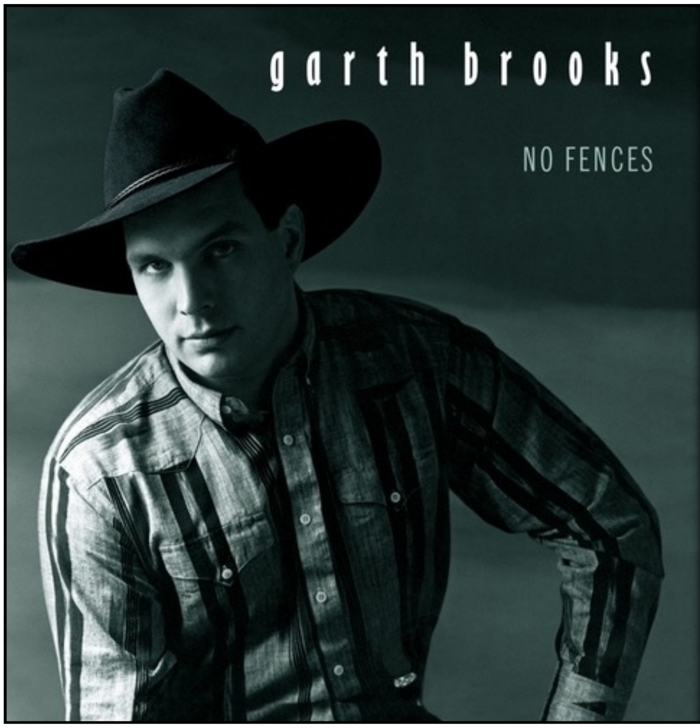
15

Core Concept #1

Fertilizer Placement Matters!

How we manage our tillage and fertilizer application can optimize nutrient availability

16



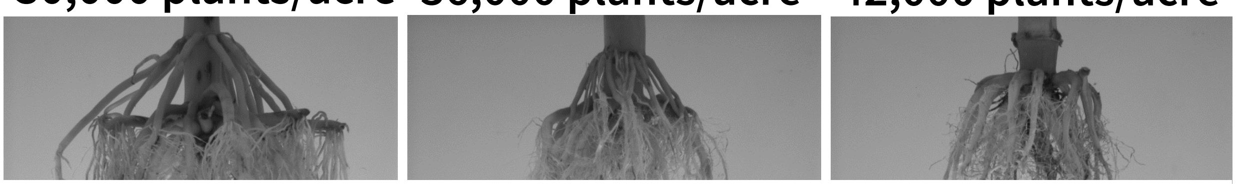
"Blame it all on my ROOTS, I showed up in boots, and ruined your black-tie affair"

'Friends in Low Places'

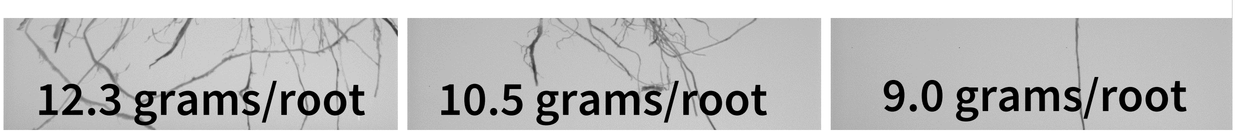
17

Increasing Plant Population = Smaller Roots

30,000 plants/acre 36,000 plants/acre 42,000 plants/acre



1% Loss of Root Mass per Plant Every Year



12.3 grams/root 10.5 grams/root 9.0 grams/root

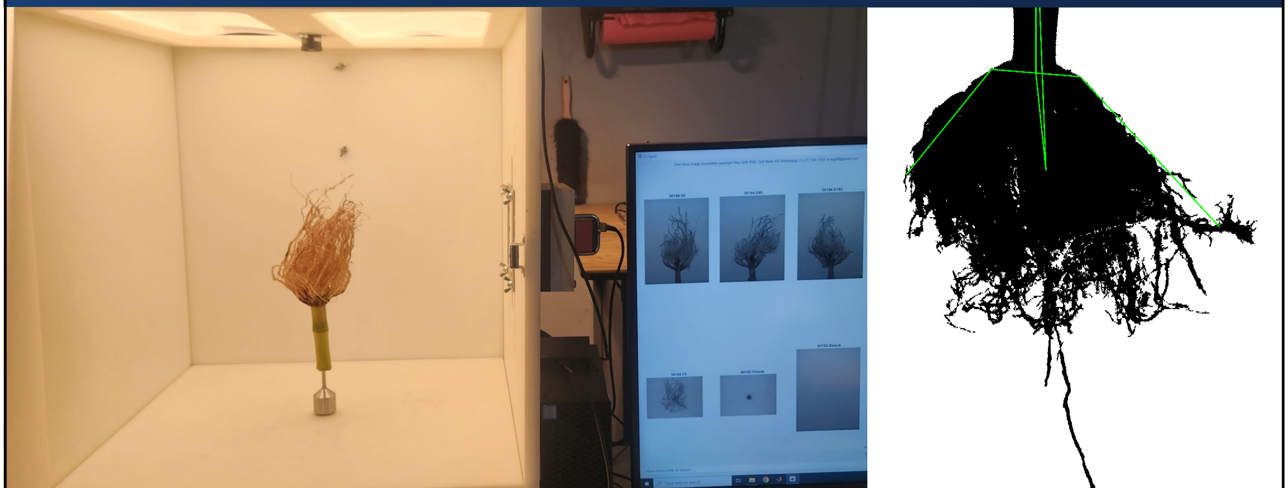
2.5% decrease in root mass per 1,000 plant increase in population

Dr. Foxhoven (2021) **All Pictures shown are G13Z50**

Crop Physiology

18

Corn Root Observation Platform (CROP)



Dr. Tony Grift – Agricultural and Biological Engineering
Dr. Martin Bohn – Crop Sciences

Crop Physiology

19

Crop Physiology

20

21

22

SAAM Rating

- Integrates root surface area, angle, and mass into one root characterization per hybrid
- Separates each measurement into two groups
  - Surface Area: Small/Large
  - Angle: Narrow/Wide
  - Mass: Small/Large
- Eight different SAAM Ratings to categorize hybrid root architecture

Crop Physiology

23

6128V2P	6152D1	6296AM	6585TCV2P	6381AM

SAAM Rating†

surface area/angle/mass

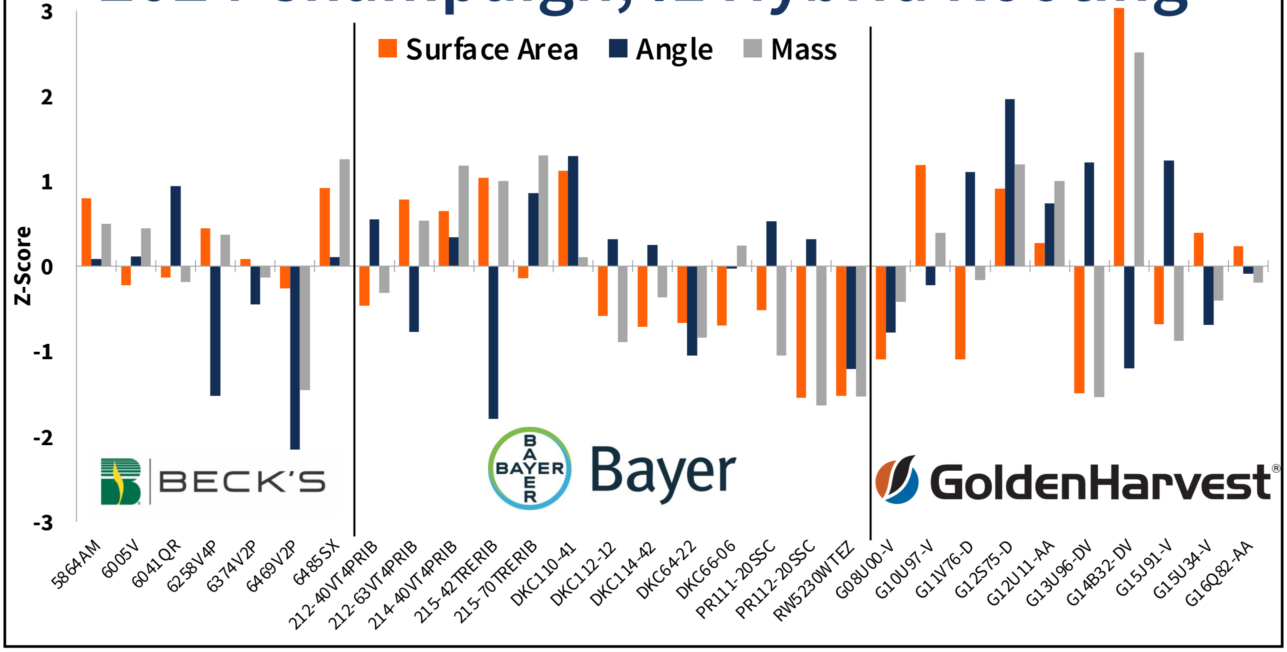
S/N/S	S/W/S	L/W/S	L/N/L	L/W/L

† Surface Area, Angle, Mass (SAAM); (W) Small (S) Large (L) Narrow (N) Wide

Crop Physiology

24

2024 Champaign, IL Hybrid Rooting



25

Core Concept #2

Hybrid root architecture varies!

Hybrid selection is likely to interact with tillage and fertilizer management.

26

Let's Go to The Field

The Crop Physiology Lab started strip-till trials in 2024, progressed into 2025…

What are we learning?

University of Illinois – Dept. of Crop Sciences

Crop Physiology

27

2024 Treatments

Tillage	Fertility	Timing
No-Till	None	Fall
Conventional		
Strip-Till (x3)	Dry P&K	Spring

Crop Physiology

28

2024 Treatments

Tillage	Fertility	Timing
1. No-Till Broadcast 2. Conventional-Till Broadcast 3. Coulter Applied 4. Shank Stratified 5. Shank Concentrated	P: 75lbs/acre of P2O5 from MESZ K: 60lbs/acre of K2O from MOP	Fall
	N: 175 units of N from UAN32 (spring applied)	Spring

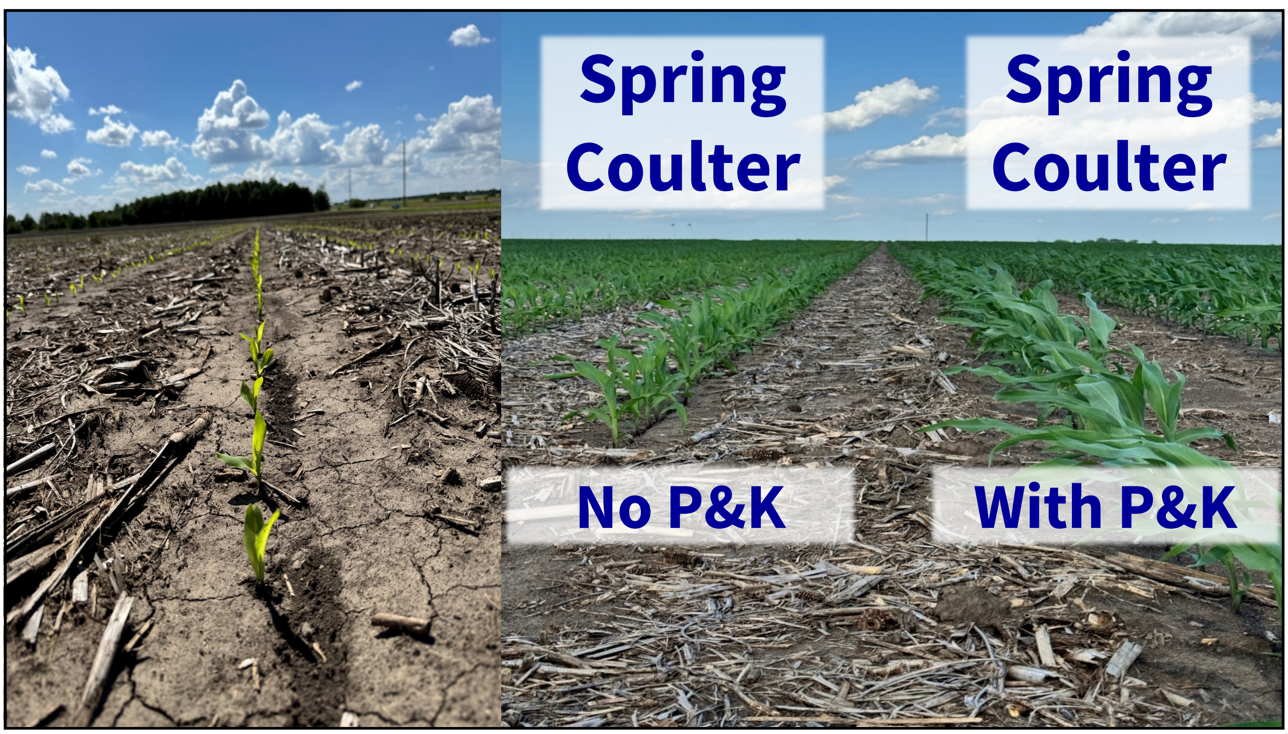
Crop Physiology

29

30


Next Strip-Till Pass: Spring
May 13th, 2024
Fall Strips
Crop
Physiology

31


Spring
Coulter
Spring
Coulter
No P&K
With P&K

32

Root Mass (grams)

Product	Fertility Timing	Root Mass
None	Fall	14.3
	Spring	13.9
P&K	Fall	15.0
	Spring	16.0*

LSD (0.05) = 0.9148

Crop Physiology

33

Root Mass (grams)

Placement	Fall UTC	Fall Fertility	Spring UTC	Spring Fertility
Coulter	14.7	14.6	13.0	16.1
Stratified Shank	14.4	15.0	14.2	16.1
Concentrated Shank	13.8	15.5	14.5	15.9
Average	14.3	15.0	13.9	16.0

Crop Physiology

34

Fertility Increases Root Mass

Placement	Fall UTC	Fall Fertility	Spring UTC	Spring Fertility
Coulter	14.7 →	14.6	13.0 →	16.1
Stratified Shank	14.4 →	15.0	14.2 →	16.1
Concentrated Shank	13.8 →	15.5	14.5 →	15.9
Average	14.3	15.0	13.9	16.0

Crop Physiology

35

Root Observations

✓ Fertility (spring especially) improves root biomass, P likely still available

- What other root characteristics are affected?

Crop Physiology

36

Root Angle (degrees)

Tillage	Angle
Coulter	69.7
Stratified Shank	73.0
Concentrated Shank	75.6

Crop Physiology

37

Root Angle (degrees)

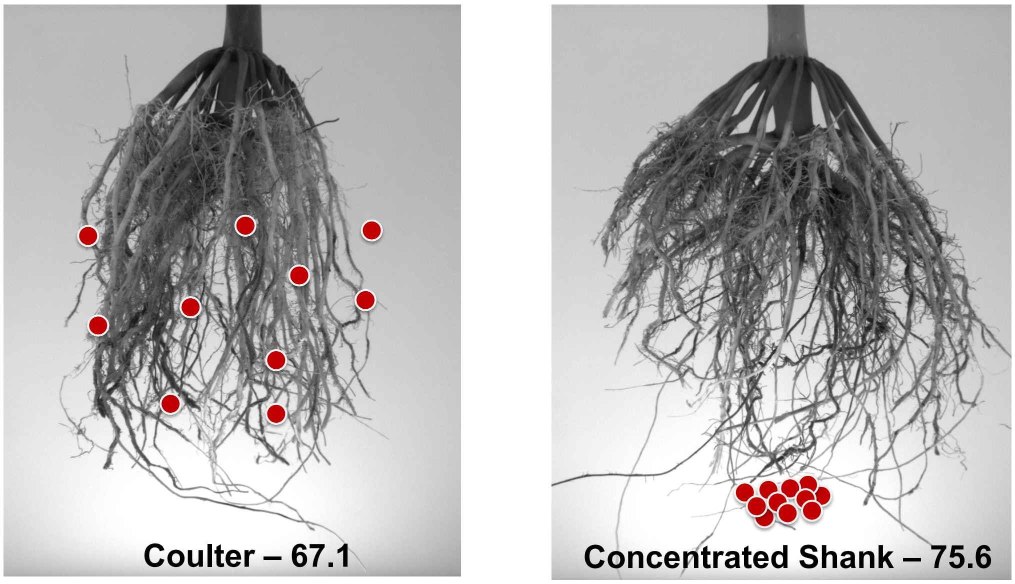
Coulter – 67.1

Concentrated Shank – 75.6

Crop Physiology

38

Root Angle (degrees)



Crop Physiology

39

Root Observations

- ✓ Fertility (spring especially) improves root biomass, P likely still available
- ✓ Fall fertility and concentrated placement result in wider-growing root angles (searching for P&K)

Crop Physiology

40

2024 Grain Yields

<table>
<tr><th></th><th colspan="2">Unfertilized</th><th colspan="2">Fertilized</th></tr>
<tr><th>Placement</th><th>Fall</th><th>Spring</th><th>Fall</th><th>Spring</th></tr>
<tr><td></td><td colspan="4">bushels/acre</td></tr>
<tr><td>No-Till</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Conventional Tillage</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Coulter</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Stratified Shank</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Concentrated Shank</td><td></td><td></td><td></td><td></td></tr>
</table>

LSD (0.05) = 9.4

Crop Physiology

41

2024 Grain Yields

<table>
<tr><th></th><th colspan="2">Unfertilized</th><th colspan="2">Fertilized</th></tr>
<tr><th>Placement</th><th>Fall</th><th>Spring</th><th>Fall</th><th>Spring</th></tr>
<tr><td></td><td colspan="4">bushels/acre</td></tr>
<tr><td>No-Till</td><td colspan="2">259</td><td></td><td></td></tr>
<tr><td>Conventional Tillage</td><td colspan="2">255</td><td></td><td></td></tr>
<tr><td>Coulter</td><td>259</td><td>258</td><td></td><td></td></tr>
<tr><td>Stratified Shank</td><td>256</td><td>251</td><td></td><td></td></tr>
<tr><td>Concentrated Shank</td><td>261</td><td>257</td><td></td><td></td></tr>
</table>

No Large Yield Difference Among Tillage Practices

LSD (0.05) = 9.4

Crop Physiology

42

2024 Grain Yields

	Unfertilized		Fertilized	
Placement	**Fall**	**Spring**	**Fall**	**Spring**
	bushels/acre			
No-Till	259			
Conventional Tillage	255			
Coulter	+1	258		
Stratified Shank	+5	251		
Concentrated Shank	+4	257		

Fall Tended to have a small benefit over spring – mellowing of strips

LSD (0.05) = 9.4

Crop Physiology

43

2024 Grain Yields

	Unfertilized		Fertilized	
Placement	**Fall**	**Spring**	**Fall**	**Spring**
	bushels/acre			
No-Till	259		249	241
Conventional Tillage	255		263	262
Coulter	259	258	263	258
Stratified Shank	256	251	255	262
Concentrated Shank	261	257	264	261

LSD (0.05) = 9.4

Crop Physiology

44

2024 Grain Yields

Placement	Unfertilized Fall	Unfertilized Spring	Fertilized Fall	Fertilized Spring
	bushels/acre			
No-Till	259		-10	-18
Conventional Tillage	255			
Coulter	259	258		
Stratified Shank	256	251		
Concentrated Shank	261	257		

LSD (0.05) = 9.4

Crop Physiology

45

2024 Lodging (1-10 Scale)

Placement	Unfertilized Fall	Unfertilized Spring	Fertilized Fall	Fertilized Spring
	Lodging Rating			
No-Till	3.3		5.0	5.8
Conventional Tillage				
Coulter				
Stratified Shank				
Concentrated Shank				

Larger plants with shallow or non-uniform planting = more lodging

LSD (0.05) = 9.4

Crop Physiology

46

2024 Grain Yields

	Unfertilized		Fertilized	
Placement	Fall	Spring	Fall	Spring
	bushels/acre			
No-Till	259		-10	-18
Conventional Tillage	255			
Coulter	259	258		
Stratified Shank	256	251		
Concentrated Shank	261	257		

LSD (0.05) = 9.4

Crop Physiology

47

2024 Grain Yields

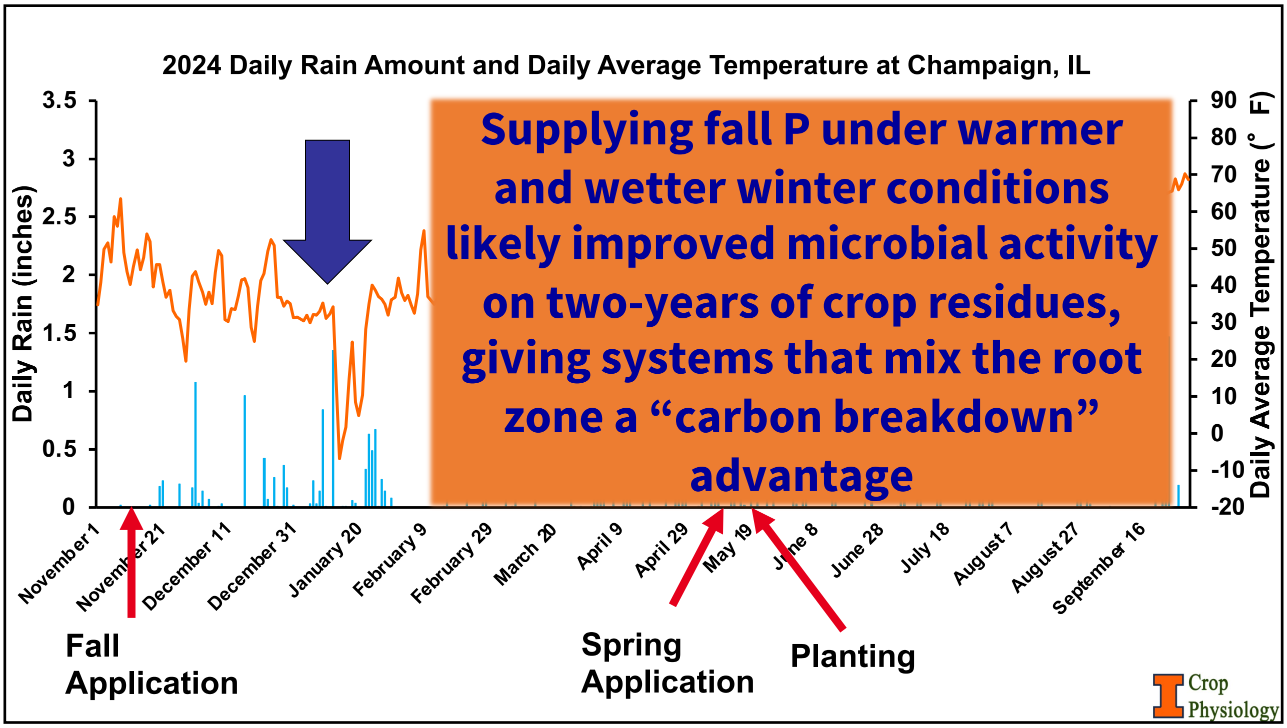
	Unfertilized		Fertilized	
Placement	Fall	Spring	Fall	Spring
	bushels/acre			
No-Till			-10	-18
Conventional Tillage			+8	+7
Coulter			+5	±0
Stratified Shank			-1	+11
Concentrated Shank			-3	+4

"Mixed" systems benefited with fall fertilizer; "Concentrated" systems preferred spring-applied

LSD (0.05) = 9.4

Crop Physiology

48



49

2024 Showed Us…

- In the absence of fertilizer, all tillage was the same, some benefit to fall application
- Fall fertilizer performed better when applied in a more "mixed" manner - fall had wider roots
- Spring fertilizer performed better when applied in a more concentrated approach – larger root gain

University of Illinois – Dept. of Crop Sciences

Crop Physiology

50

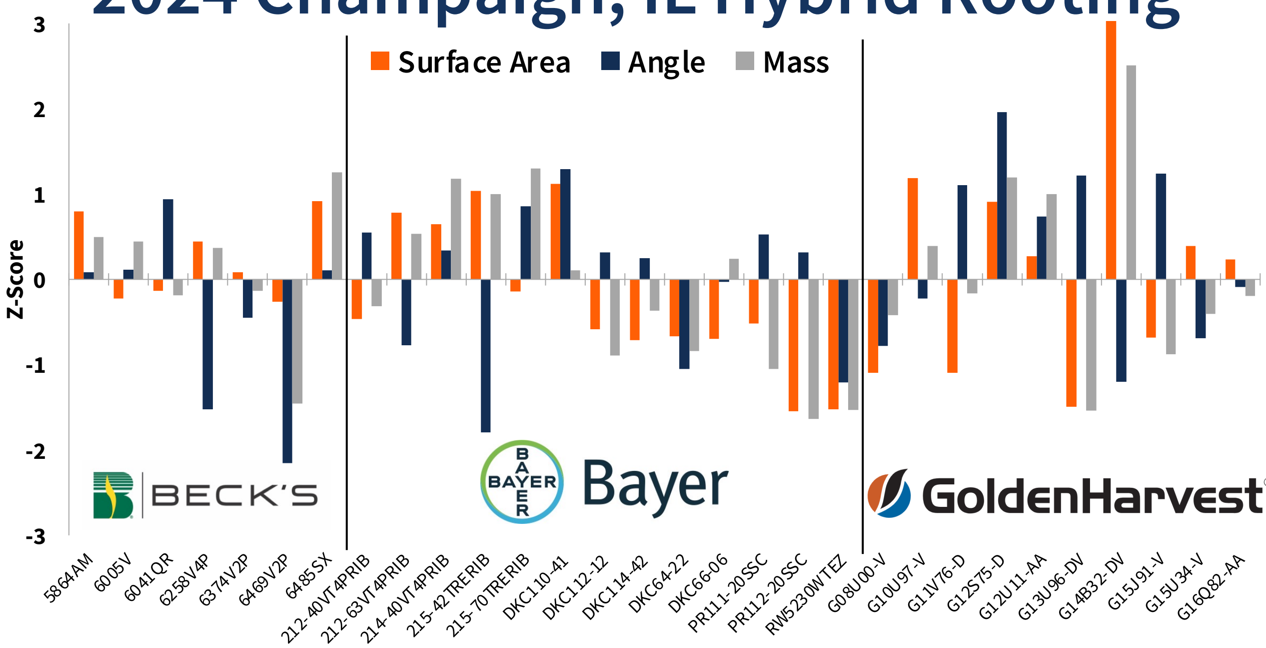
2025 Treatments

Tillage	Fertility	Timing
No-Till	None	
Conventional		
Strip-Till (x3)	Dry P&K	Spring

Crop Physiology

51

2024 Champaign, IL Hybrid Rooting



52

2025 Hybrid x Tillage

Dekalb	Golden Harvest	Becks	LG	Channel
114-99 VT4PRO	15J91-V	6280V2P	62C73VT2	215-70TRE
110-41 TRE	14B32-DV	6469V2P		
66-06 TRE	13M31-AA	6485SX	64C43VT2	212-63VT4
114-42 SSPRO	13U96-DV	6344SXP		

Crop Physiology

53

2025 Grain Yields

Placement	Unfertilized	Fertilized
	bushels/acre	
No-Till	280	
Conventional Tillage	282	
Coulter	279	
Stratified Shank	278	
Concentrated Shank	277	
Fertility Average	279	

No Large Yield Difference Among Tillage Practices

LSD (0.05) = 5

Crop Physiology

54

2025 Grain Yields

Placement	Unfertilized	Fertilized
	bushels/acre	
No-Till	280	290
Conventional Tillage	282	285
Coulter	279	283
Stratified Shank	278	288
Concentrated Shank	277	281
Fertility Average	279	285

LSD (0.05) = 5

Crop Physiology

55

2025 Grain Yields

Placement	Unfertilized	Fertilized
	bushels/acre	
No-Till	280	+10
Conventional Tillage	282	+3
Coulter	279	+4
Stratified Shank	278	+10
Concentrated Shank	277	+4
Fertility Average	279	+6

LSD (0.05) = 5

Crop Physiology

56

2025 Grain Yields

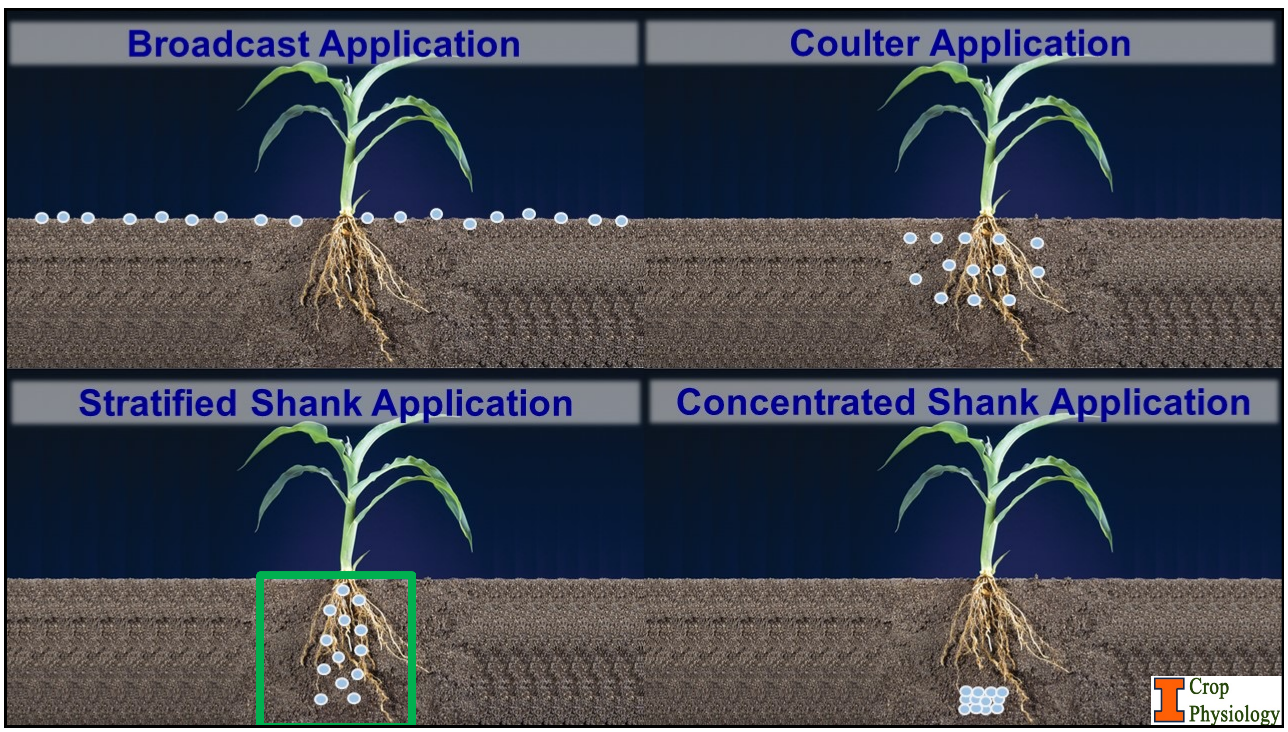
Narrowing the Fertilizer Placement to the Crop Row and with Depth Provided Greatest Response to Spring P & K

Placement	2024 Fert Response.	2025 Fert Response.
Stratified Shank	+11	+10
Concentrated Shank	+4	+4
Fertility Average	-18	+6

LSD (0.05) = 5

Crop Physiology

57



58

Multi-Year Fertility Management in Corn and Soybean Production

Sam Leskanich, Connor Sible, & Fred Below

Crop Physiology Laboratory
Department of Crop Sciences
University of Illinois Urbana-Champaign

Crop Physiology

59

Research Questions

- What are the long-term effects of multi-year fertilizer applications?
  - Do soybeans like "old" fertility?
- Are multi-year blends more economical in a long-term fertility system?

Crop Physiology

60

Treatments

Treatment	Years Applied
Untreated Control (UTC)	-
Biennial Corn-Only Application	2021, 2023
Annual Application to Either Crop	2021, 2022, 2023, 2024
Biennial Two-Crop Amount	2021, 2023
Single Four-Crop Amount	2021

All corn treatments were balanced for 180 lbs N/acre with urea

Crop Physiology

61

4 Year Grain Yield Summary

Treatment	2021 Corn	2022 Soybean	2023 Corn	2024 Soybean
	bushels/acre			
UTC	258			
Corn-Only	264 +6	+4	+8	+5
Annual	262 +4	-1	+7	+5
Two-Crop	266 +8	+5	+14	+4
Four-Crop	262 +4	+2	+10	+4
LSD(0.1)	ns			

Crop Physiology

62


4-Year Summary
The Two-Crop Fertilization Produced the Greatest Yields, Highest Soil Tests, and a Sustainable ROI
Crop Physiology

63


What About Strip-Till?
Crop Physiology

64

2024 Strip-Till Grain Yield

Treatment	Year 1 Corn
	bushels/acre
UTC	240
Corn-Only	252 +12
Two-Crop	254 +14
LSD(0.1)	6

Crop Physiology

65

66


On-Strip
Mid-Row
Previous Year's Corn Plants
May 22nd, 2025
Crop
Physiology

67


On-Strip
Mid-Row
June 24th, 2025
Crop
Physiology

68


On-Strip
Mid-Row
July 29th, 2025
Crop
Physiology

69


Mid-Row
Corn-Only
Two-Crop
July 29th, 2025
Crop
Physiology

70

2025 Soybean Strip-Till Grain Yield

Treatment	Planting Position: On-Strip	Planting Position: Mid-Row	Average
	bushels/acre		
UTC	53.4	54.8	54.1[B]
Corn-Only	55.1	57.4	56.3[A]
Two-Crop	56.5	57.0	56.7[A]
Average	55.0	56.7	

Crop Physiology

71

2024 & 2025 Strip-Till Grain Yield

Treatment	Corn	Soybean†
	bushels/acre	
UTC	240	54.1
Corn-Only	252+5.0%	56.3+4.1%
Two-Crop	254+5.8%	56.7+4.8%
LSD(α=0.1)	6	2.0

† Soybean Yields averaged over two planting placements.

Crop Physiology

72

Strip-Till Grain Yield Findings

- The Two-Crop fertilization produced only 0.7-0.8% more yield than Corn-Only, showing that reduction of rates can be implemented for the short-term in a strip-till system due to the concentration of nutrients.
- Avoiding corn residue by shifting the soybean row position to the mid-row resulted in a slight yield increase through numerically greater seed numbers and weights.
- Fertilizing in the mid-row slightly increased seed weights.

Crop Physiology

73

In Summary

- **Tillage × Fertilizer Strategies Vary**
  - **There is no "one size fits all"**
  - **Understand how each system works**
  - **Optimize hybrid selection to fit your system**
- **Strip-Till Can Offer Maintained or Improved Yield**
  - **Strip-till does not have to 'beat' conventional**
  - **There can be long-term gains to residue preservation and systems management**

University of Illinois – Dept. of Crop Sciences

Crop Physiology

74

Thank You to Indiana CCA!

More info at:
Crop Physiology Laboratory
University of Illinois
http://cropphysiology.cropsci.illinois.edu

Crop Physiology

University of Illinois – Dept. of Crop Sciences

Crop Physiology

75