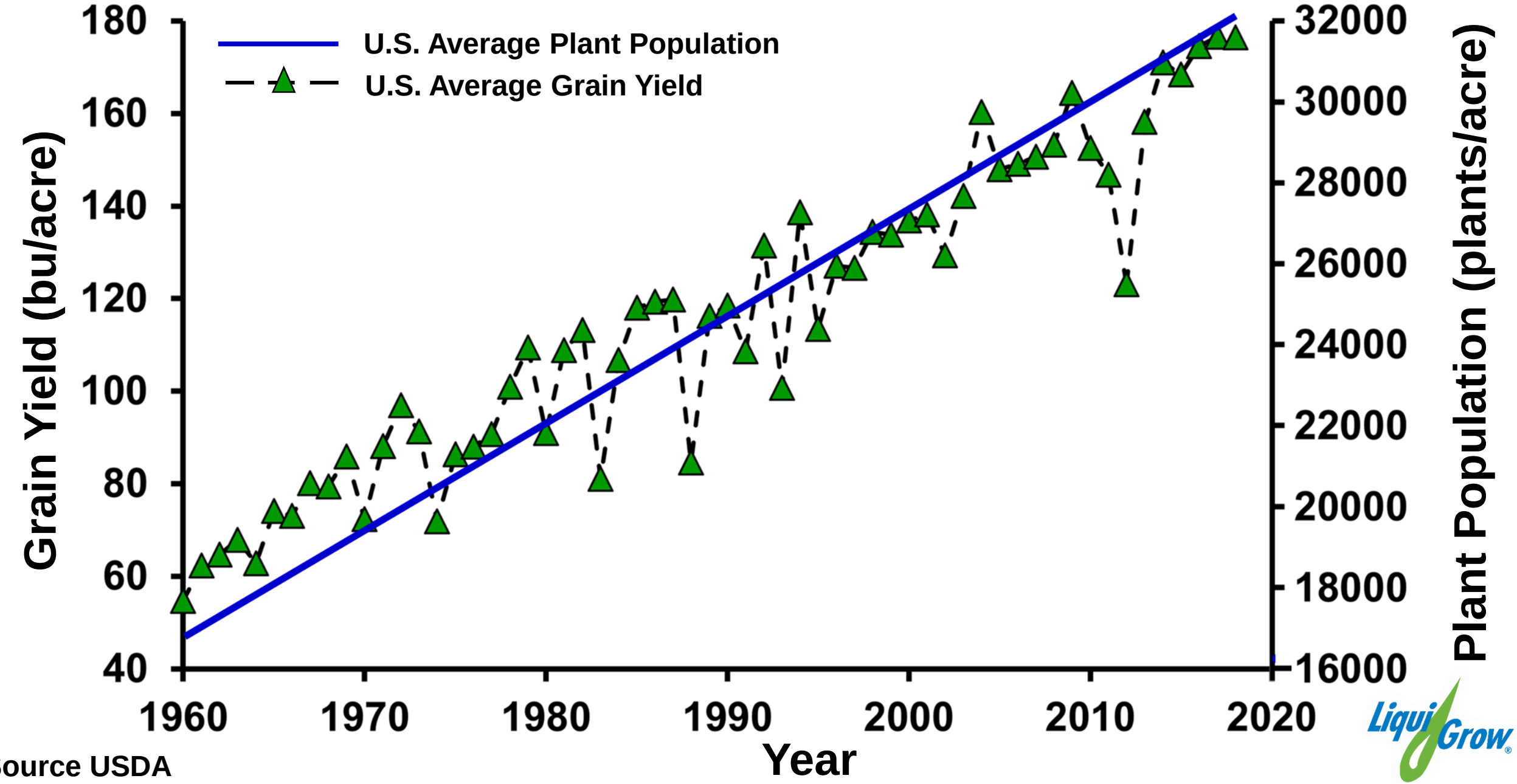
Y-Drop Research And Rationale

In-season Nutrient Management

Brad Bernhard

2019 Fluid Fertilizer Foundation Technology Workshop
Council Bluffs, IA December 12th, 2019

Historic Corn Grain Yield and Plant Population



Source USDA

Nutritional Needs For Corn

Grain Yield	N	P_2O_5	K_2O
bushels/acre	lbs/acre		
150	150	81	210
200	200	108	280
250	250	135	350
300	300	162	420

IPNI Nutrient Uptake Totals, 2014

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Nutrient Use Efficiency

Yield Efficiency

- yield produced per unit of applied nutrient

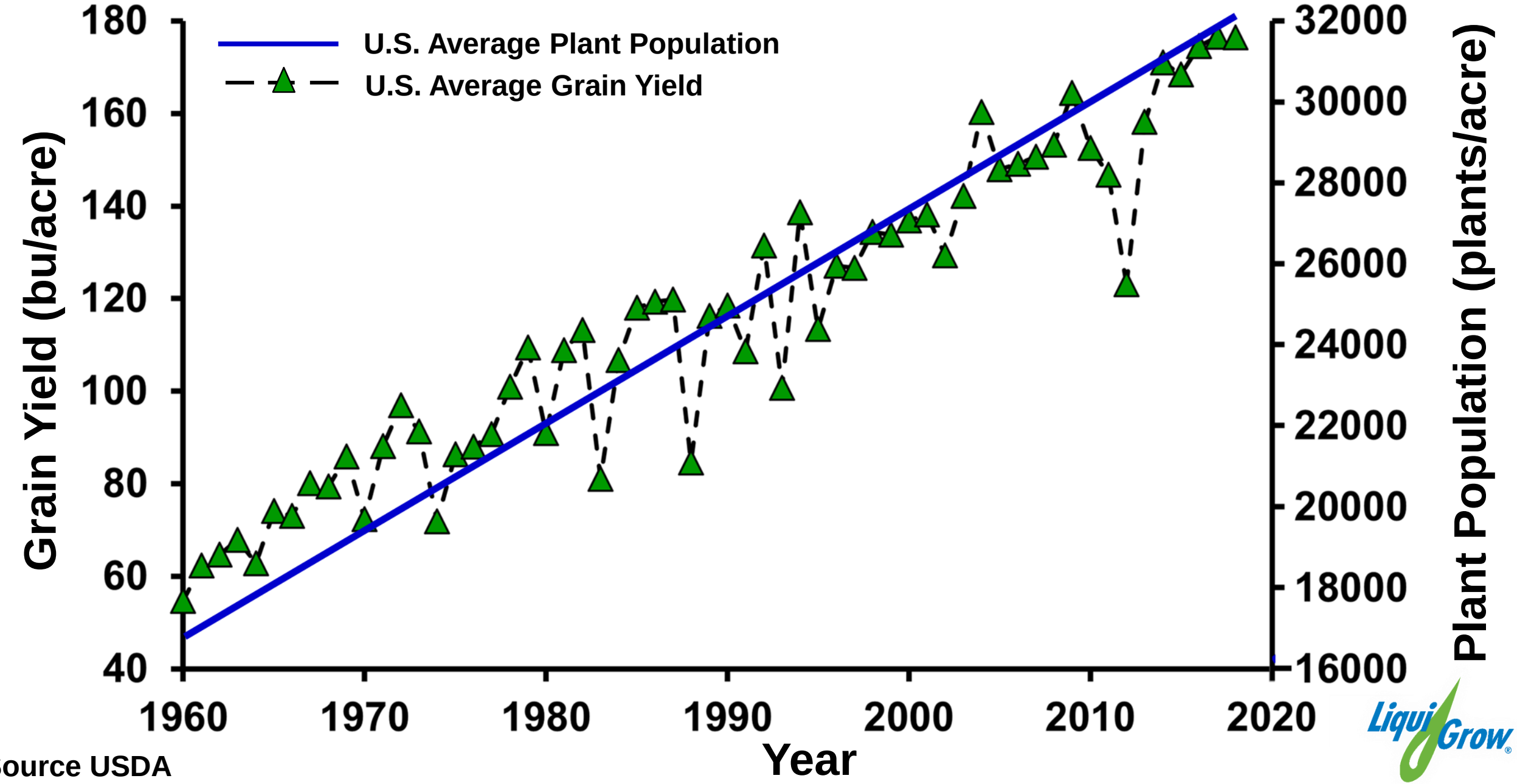
Recovery Efficiency

- amount of applied fertilizer recovered in the plant

Physiological Efficiency

- yield produced per unit of nutrient absorbed by the plant

Historic Corn Grain Yield and Plant Population



Source USDA

Effect of Plant Population on Corn Root Systems

What happens to the size of the root system as plant populations are increased?

They Get Smaller

Root Digging/ Washing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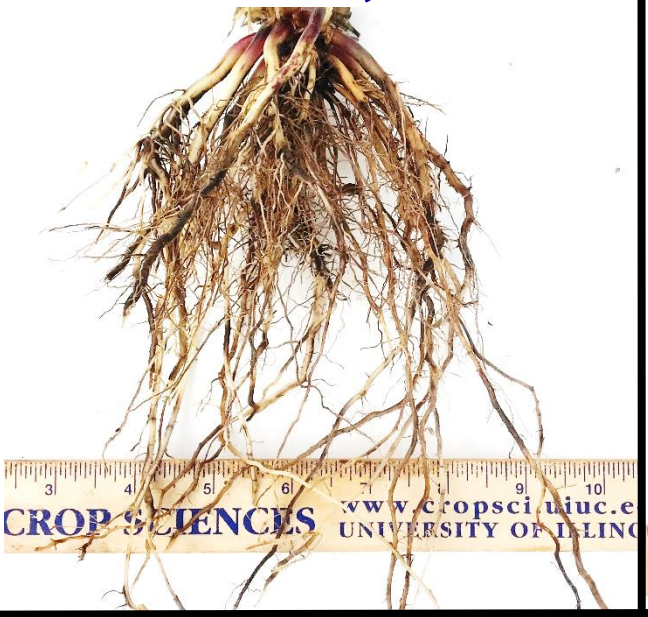
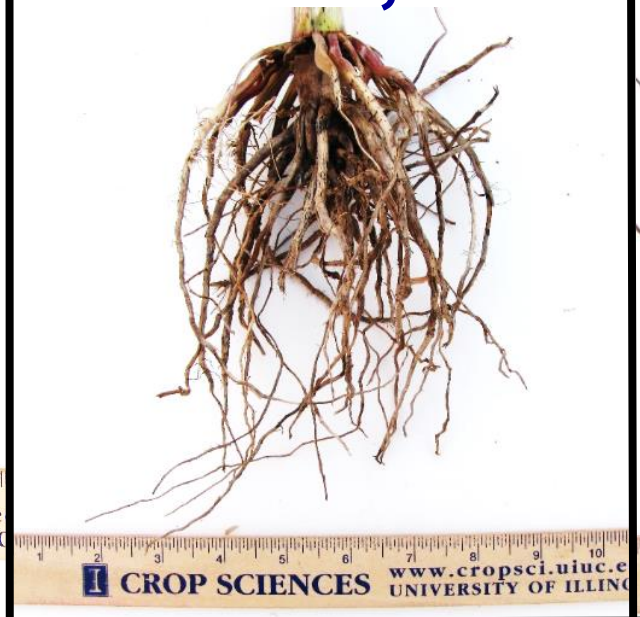
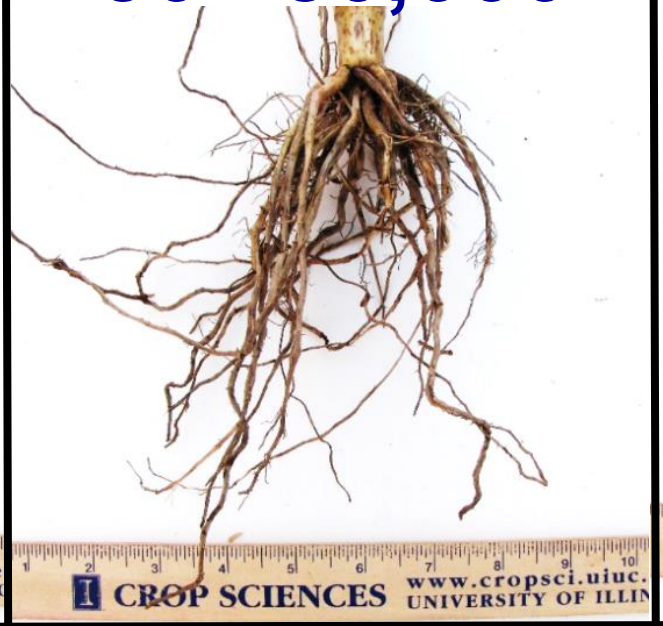
30” 38,000



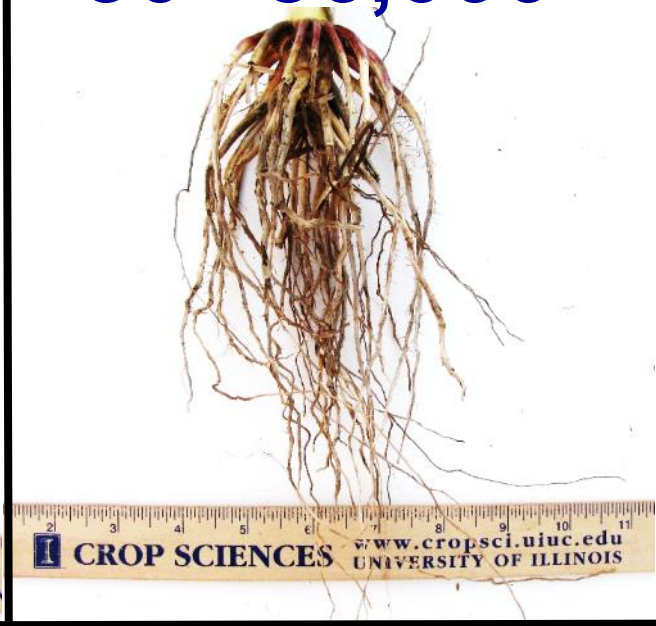
30” 44,000



30” 50,000



30” 56,000



20” 38,000

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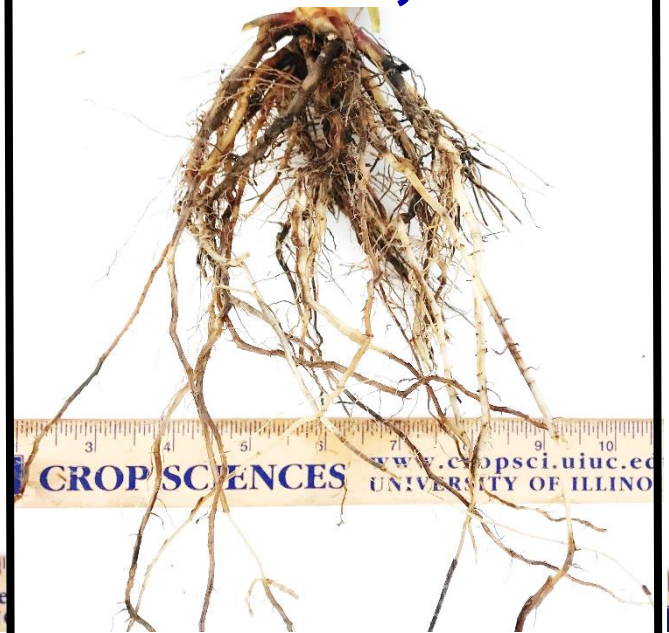

20” 56,000

Individual Root Weight

Row Spacing	Planting Population (plants per acre)				
	38,000	44,000	50,000	56,000	Avg
	grams per root				
30”	12.2	10.2	8.6	6.8	9.4
20”	14.6	12.5	10.3	8.6	11.5
Avg	13.4	11.4	9.4	7.7	

LSD (0.05) Spacing = 0.5
LSD (0.05) Planting Density = 0.4
LSD (0.05) Spacing x Planting Density = 0.6
Measured Post - Harvest
Averaged Across 4 Site-Years and 6 Hybrids

Individual Root Weight

Row Spacing	Planting Population (plants per acre)				
	38,000	44,000	50,000	56,000	Avg
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Avg	13.4	11.4	9.4	7.7	

Takeaway: Continued Increases in Planting Population will Further Magnify the Importance of Nutrient Management

LSD (0.05) Spacing = 0.5
LSD (0.05) Planting Density = 0.4
LSD (0.05) Spacing x Planting Density = 0.6
Measured Post - Harvest
Averaged Across 4 Site-Years and 6 Hybrids

Nitrogen Management to Improve Grain Yield and Nutrient Use Efficiency

LiquiGrow®

Evaluations

Fertilizer Source

Urea versus UAN

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Fertilizer Source

Urea versus UAN

Application Timing

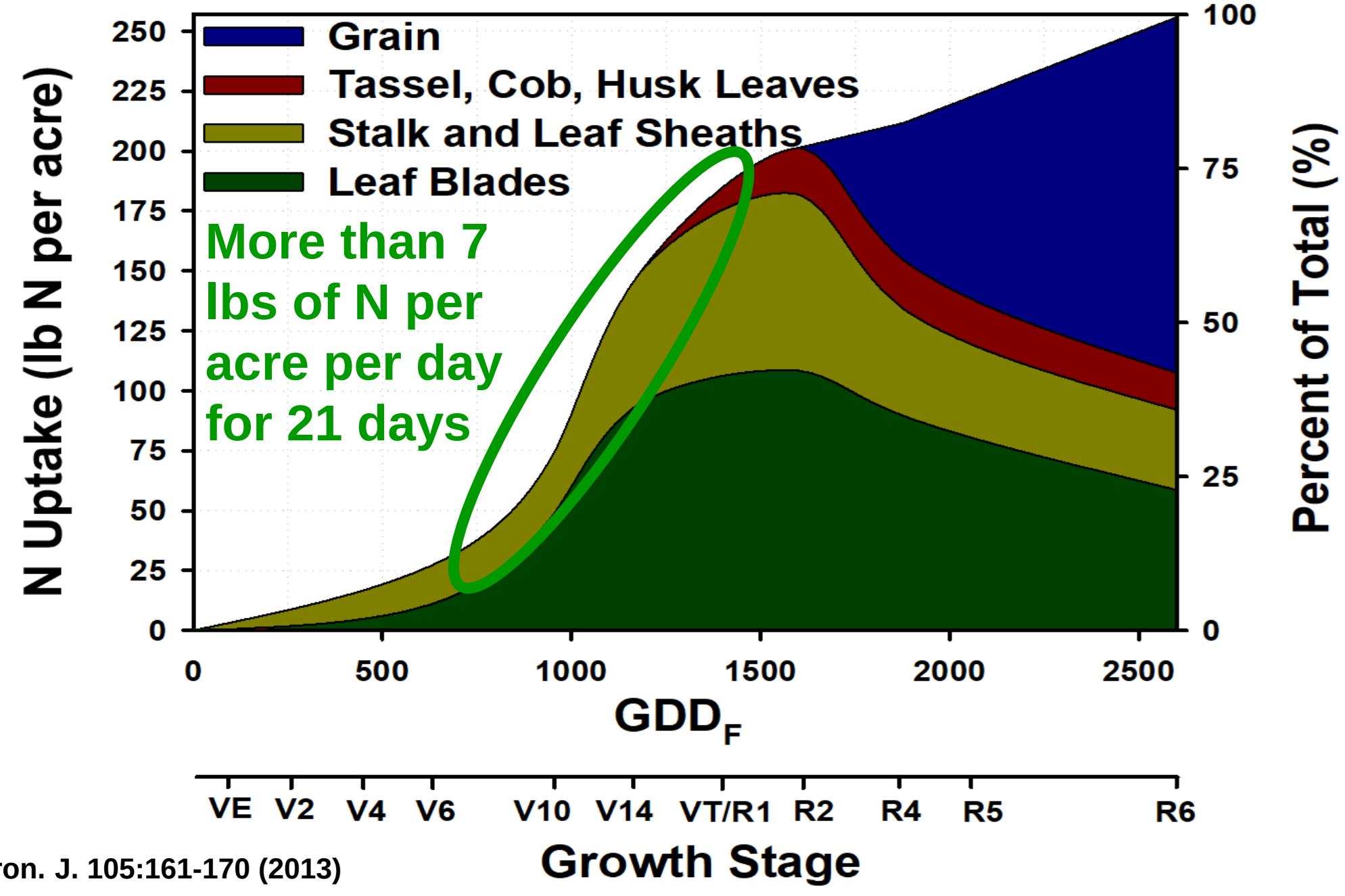
Upfront: all N applied at preplant

50/50 Split: 50% N at preplant

50% N sidedressed at V8

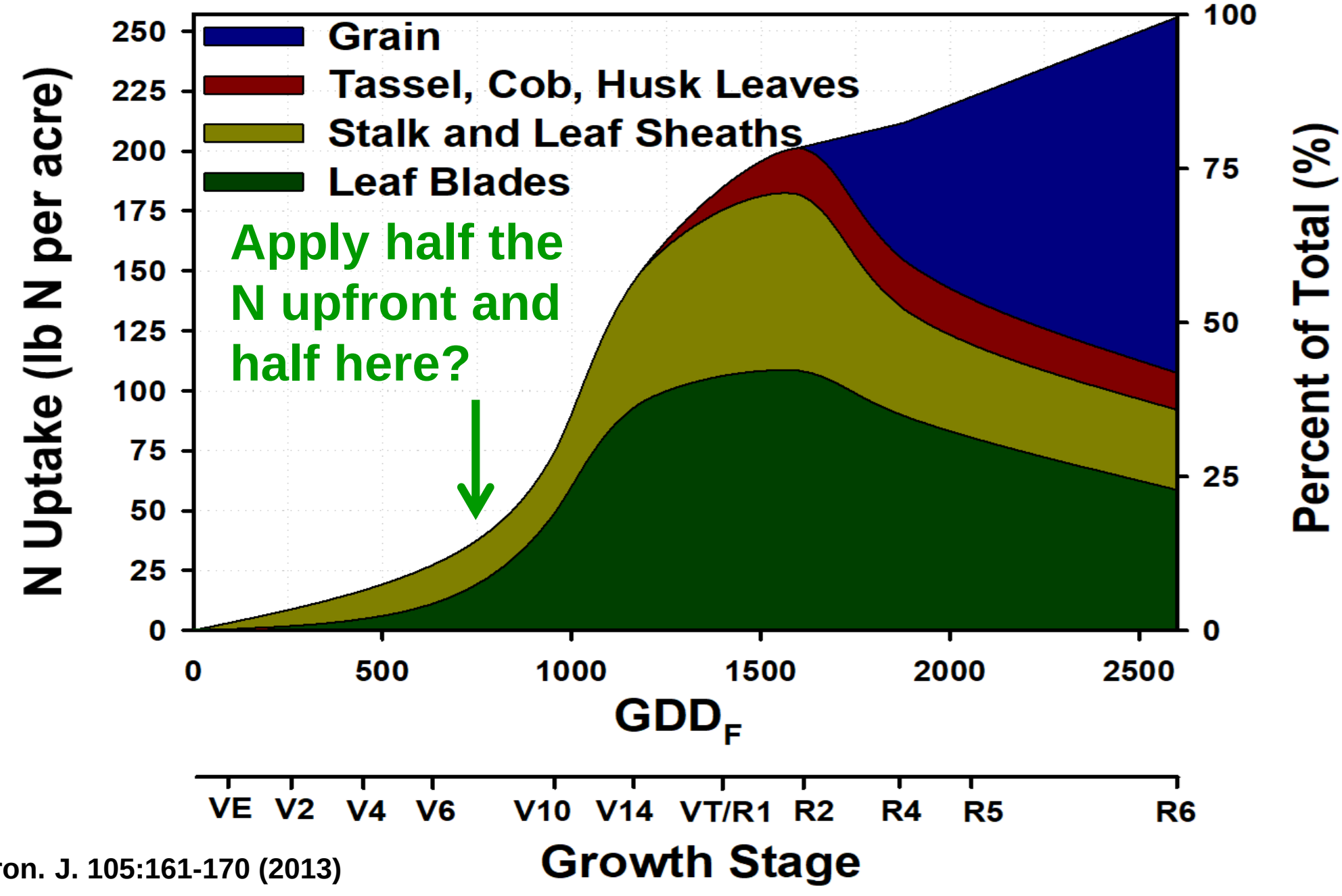
*** Total of 180 lbs of N per acre**

N Uptake & Partitioning for 230 Bushel Corn



Agron. J. 105:161-170 (2013)

N Uptake & Partitioning for 230 Bushel Corn



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Fertilizer Source

Urea versus UAN

Application Timing

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50/50 Split: 50% N at preplant

50% N sidedressed at V8

*** Total of 180 lbs of N per acre**

Application Method

V8 Growth Stage

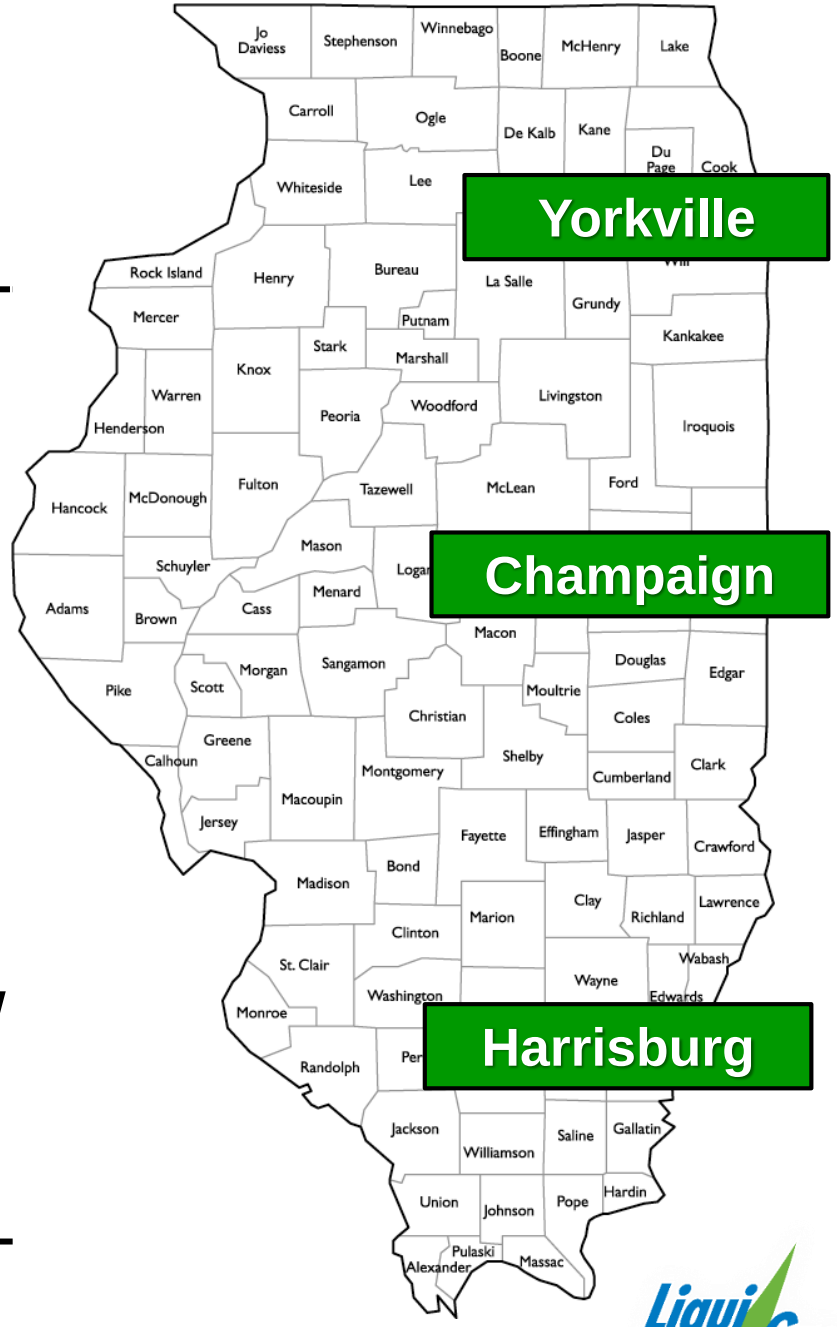
Broadcasted

Middle of Row

Next to Row

Treatments

Preplant	Sidedress
No N Applied	-
Urea Broadcast	-
Urea Broadcast	Urea Broadcast
Urea Broadcast	Urea Next to Row
Urea Broadcast	UAN Middle of Row
Urea Broadcast	UAN Next to Row



All treatments (except control) received a total of 180 lbs of N / acre
Split applications received 90 lbs of N at preplant and 90 lbs of N / acre at the V8 growth stage

LiquiGrow®

Preplant N Application

Planting

Y-Drop

Plant Water Funnel Effect


Urea Broadcast


Urea Next to Row


UAN Middle of Row

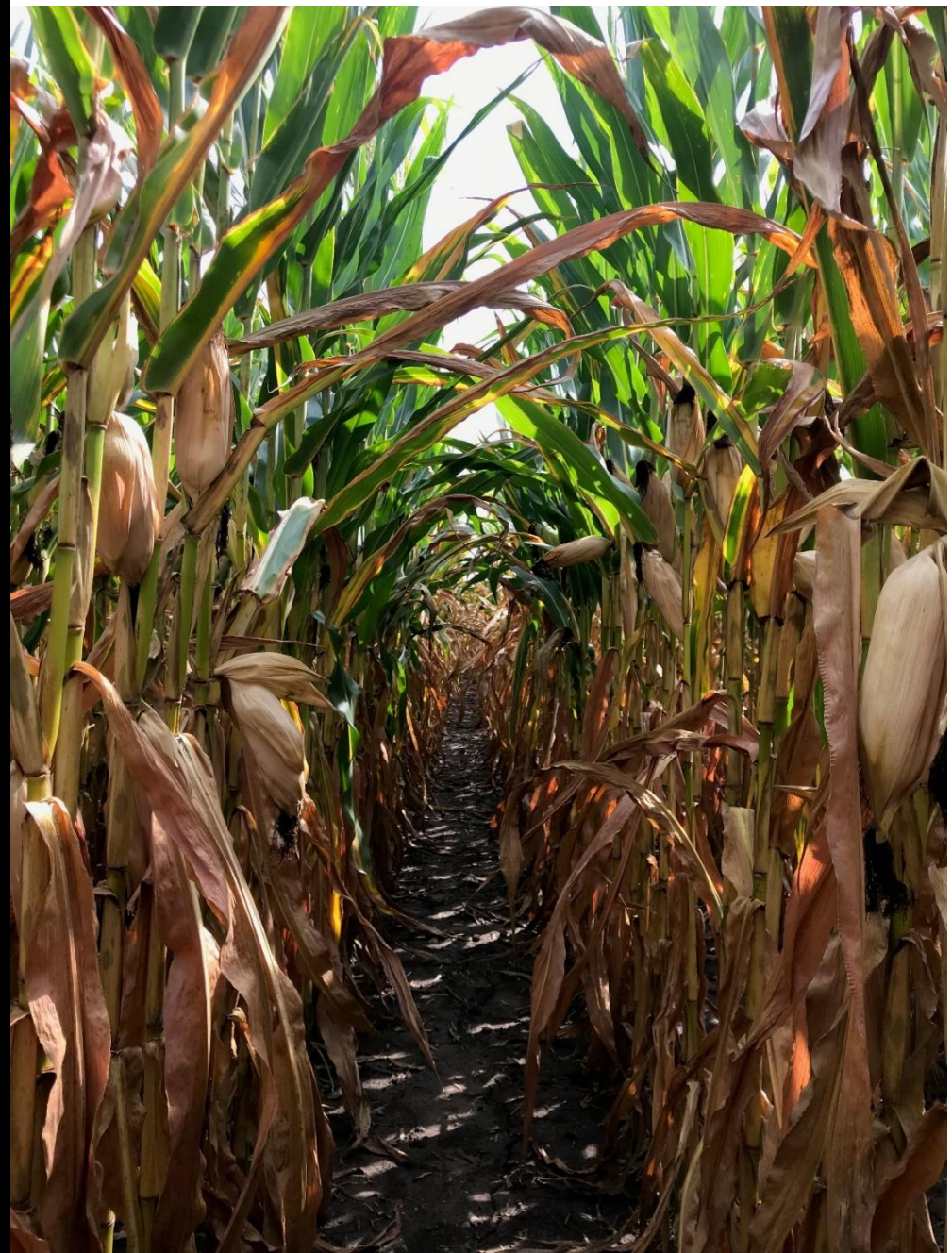

UAN Next to Row
LiquiGrow®

Sidedress Broadcast Urea

Champaign, IL August 16th, 2018

Center of Row

Y-Drop



Champaign, IL August 16th, 2018

Harvest

Differences in Check Plot Yield Per Site

Year and Location	Check Plot Yield
	bushels per acre
2018 Harrisburg	97
2018 Champaign	103
2017 Champaign	184
2018 Yorkville	195
2017 Yorkville	208
2017 Harrisburg	224

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	bushels per acre
2018 Harrisburg	97
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Treatments

Preplant	Sidedress
No N Applied	-
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Urea Broadcast	Urea Broadcast
Urea Broadcast	Urea Next to Row
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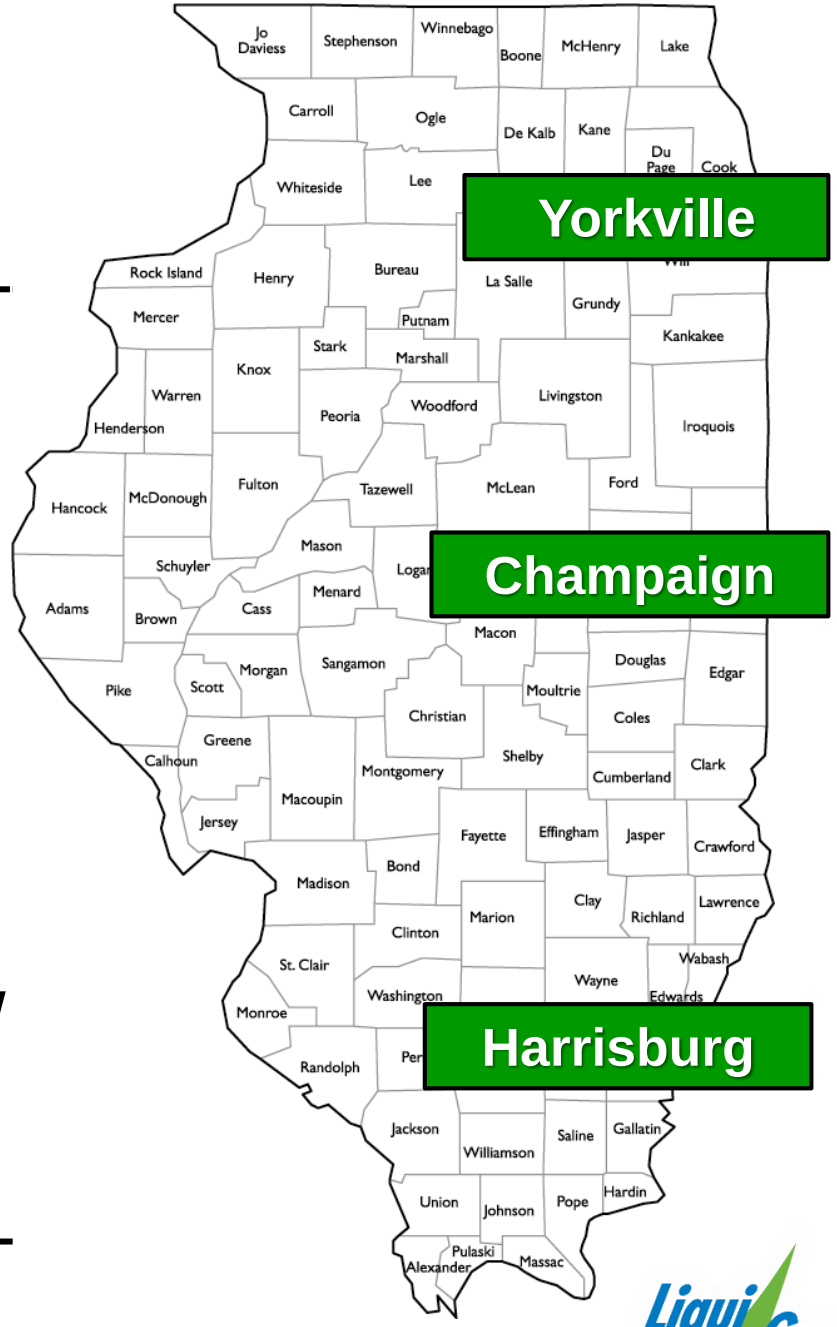

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Yield Difference from all N Applied Upfront as Urea Broadcast

Check Plot Yield Rank	Upfront Urea Broadcast	Placement of Urea Sidedress†		Placement of UAN Sidedress	
		Broadcast	Next to Row	Middle Row	Next to Row
	bu/acre	Δ bushels per acre			
18HB	190	-7	2	-2	9
18CU	222	-8	12	-17	6
17CU	256	-3	-3	-25	-11
18YV	232	3	5	9	15
17YV	265	7	5	0	13
17HB	265	8	7	9	11
Avg	238	0	5	-4	8

† Split application received 90 lbs of N as broadcast urea upfront

LSD (α = 0.05) = 5

Key Takeaways

- **Nitrogen supplying power of the soil is a good indication of plant yield-response to split-applied N.**

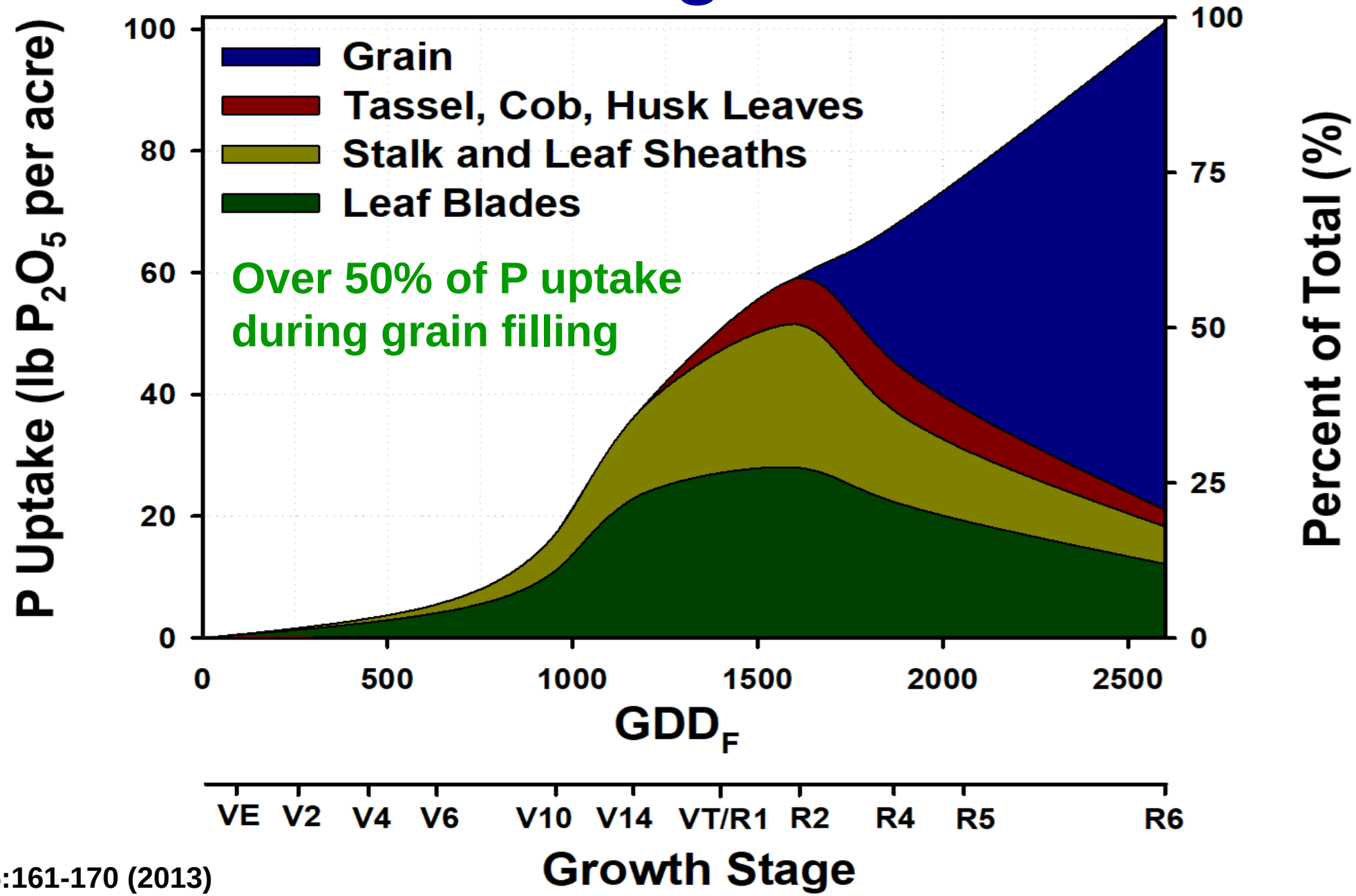
- **When sidedressing N, placing the N in close proximity to the crop row resulted in greater yields.**

Key Takeaways

- **The sidedress N treatment that resulted in the greatest corn grain yield was placing UAN along the crop row using Y-drops.**

Potential for In-season Phosphorus Fertility Management

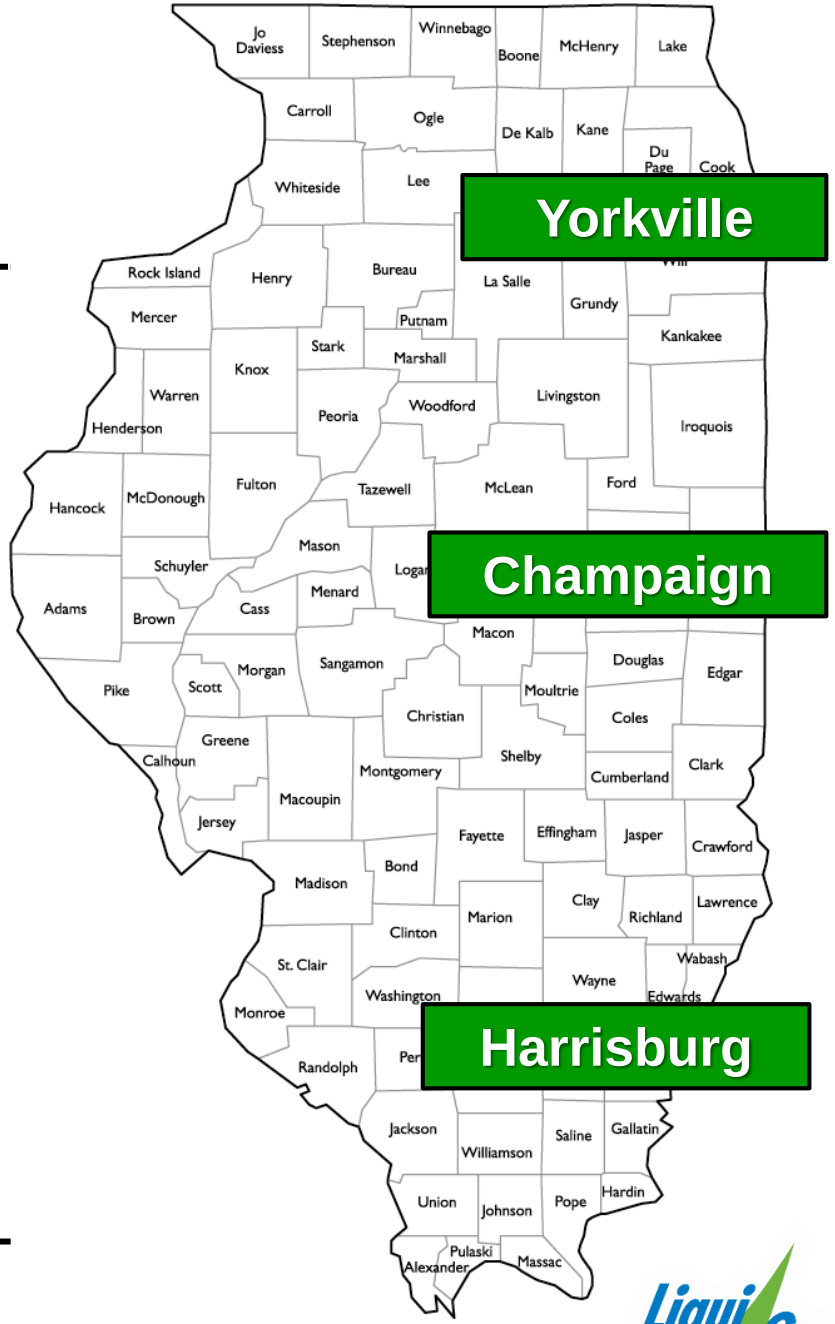
P Uptake & Partitioning for 230 Bushel Corn



Agron. J. 105:161-170 (2013)

Treatments

Planting	Sidedress
Control	-
10-34-0 In-furrow (5†)	-
10-34-0 In-furrow (10)	-
10-34-0 In-furrow (15)	-
10-34-0 In-furrow (5)	10-34-0 Y-drop (10)
-	10-34-0 Y-drop (10)
-	10-34-0 Y-drop (15)



Base rate of 180 lbs N/acre at preplant (Control)
† gallons of 10-34-0 per acre
Sidedress applications were made at the V8 growth stage

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In-Furrow Application

LiquiGrow®

Y-Drop


Untreated
10-34-0
5 gal/acre
LiquiGrow®


10-34-0 Burn
15 gal/acre
LiquiGrow®

Grain Yield Averaged Across All Locations

Treatment		Yield
Planting	Sidedress	
		bushels per acre
Control	-	265
10-34-0 In-furrow (5†)	-	271
10-34-0 In-furrow (10)	-	266
10-34-0 In-furrow (15)	-	254
10-34-0 In-furrow (5)	10-34-0 Y-drop (10)	276
-	10-34-0 Y-drop (10)	271
-	10-34-0 Y-drop (15)	274

Base rate of 180 lbs N/acre at preplant (Control)
† gallons of 10-34-0 per acre
Sidedress applications were made at the V8 growth stage
LSD (α = 0.10) = 5

Key Takeaways

In-season applications of 10-34-0 can be an effective method to provide the growing crop with late season phosphorus nutrition.

Key Takeaways

In-furrow applications of 10-34-0 provided the greatest yield increase per unit of nutrient applied.

Sidedressing Corn with Potassium In-season

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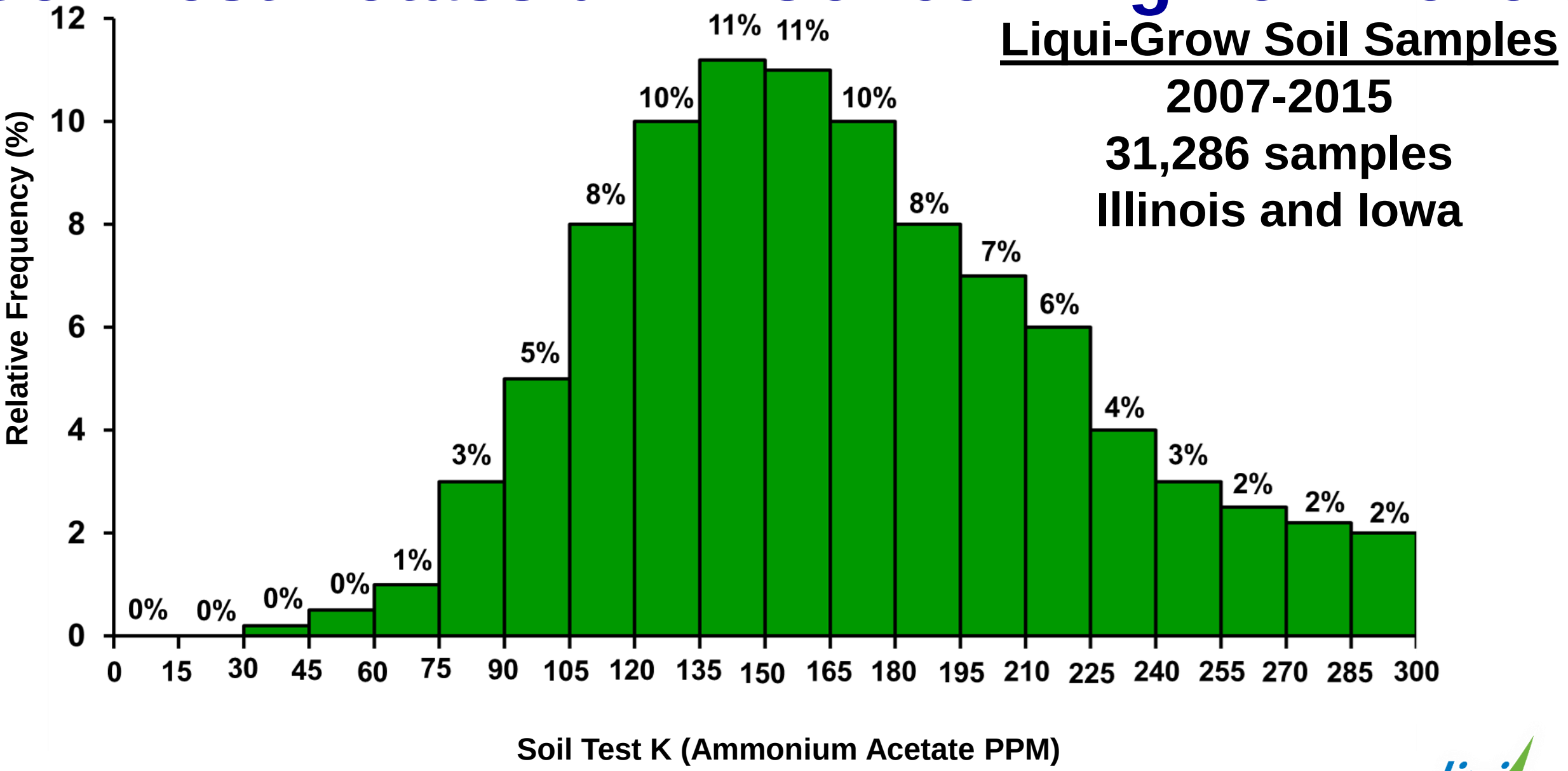
Soil Test Potassium – Concerning Low Levels



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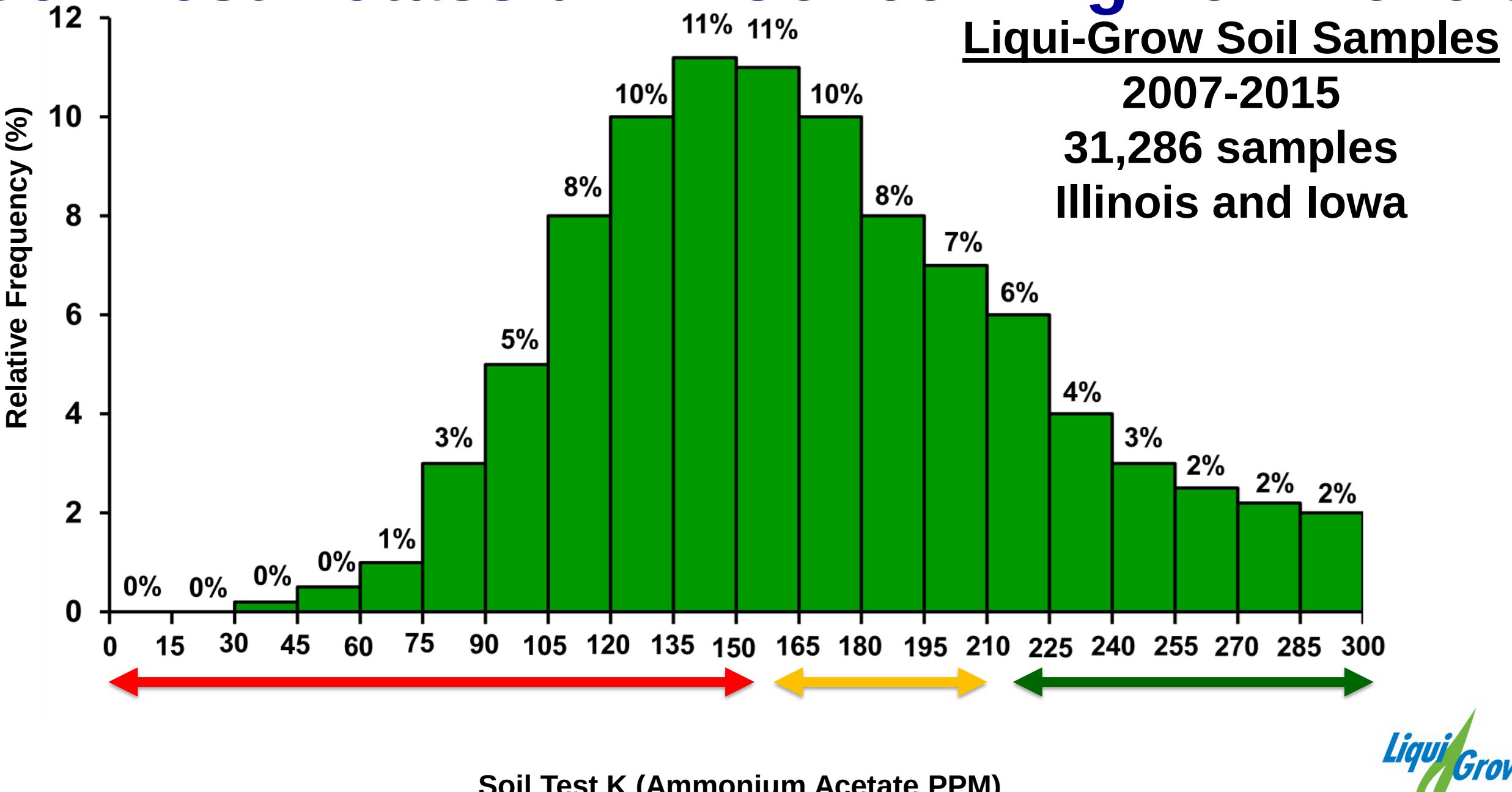

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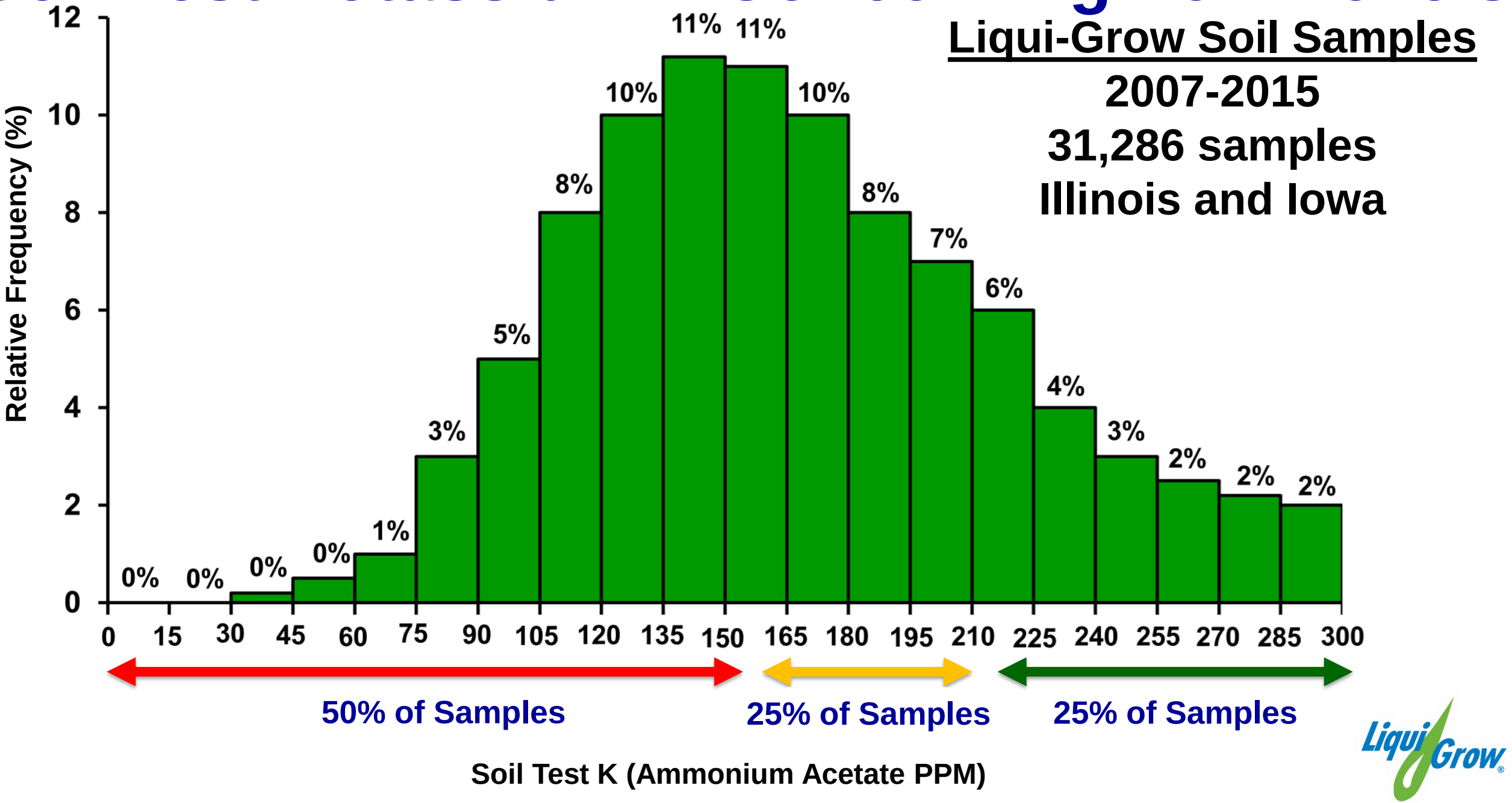
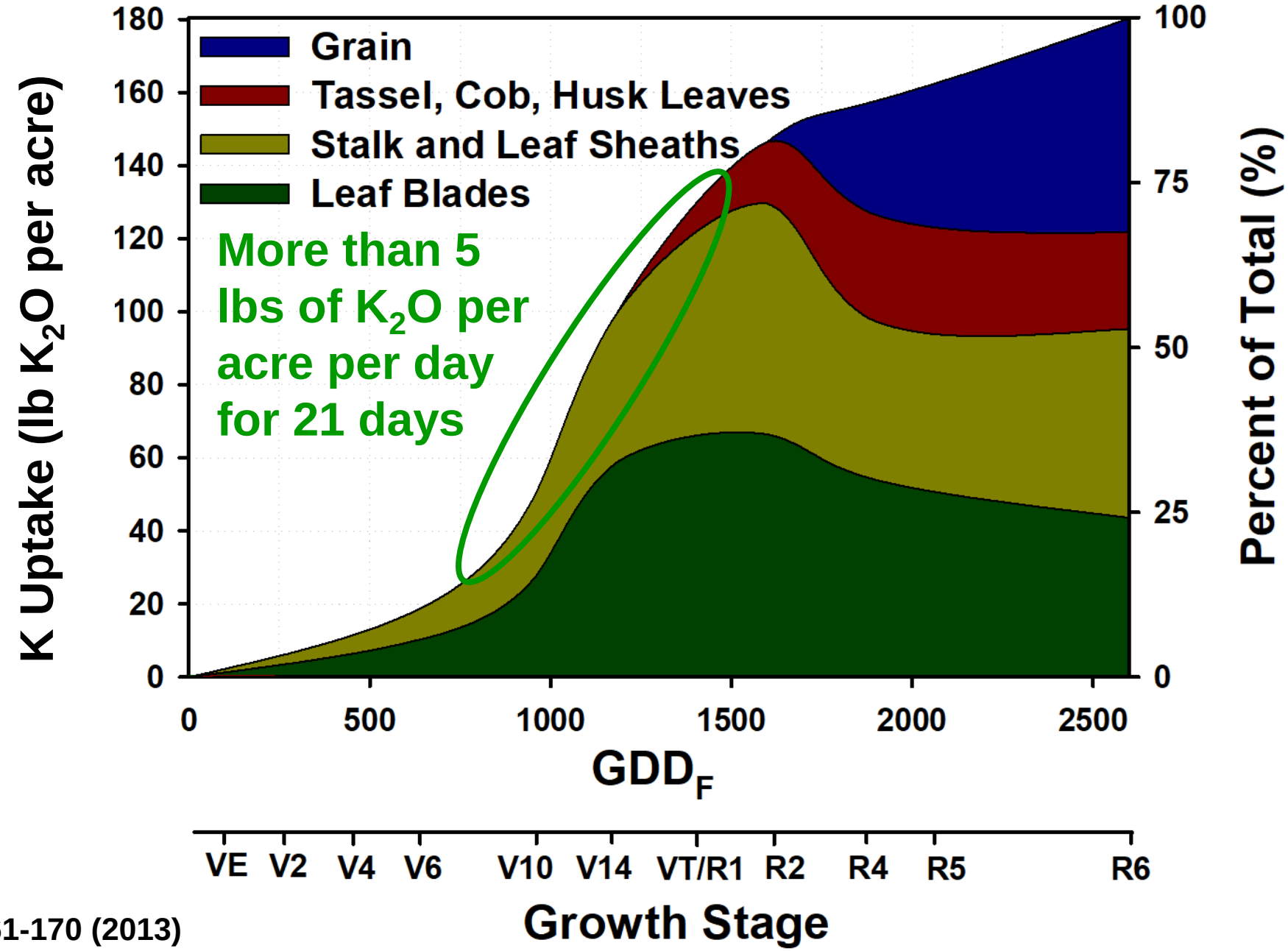


K Uptake & Partitioning for 230 Bushel Corn



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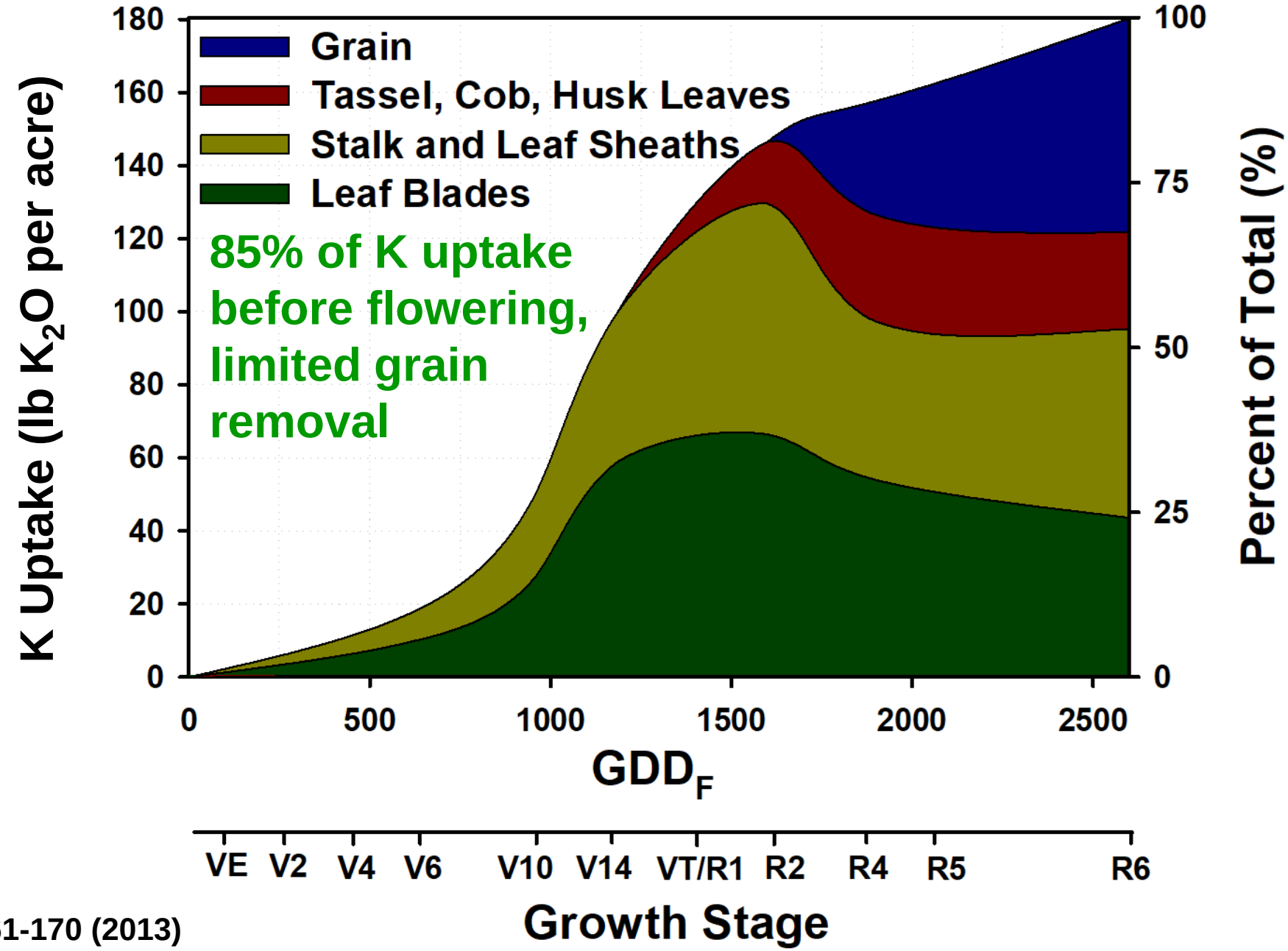
K Uptake & Partitioning for 230 Bushel Corn



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In-season Potassium Fertility Trial

On-Farm Strip Trials – 15 Locations

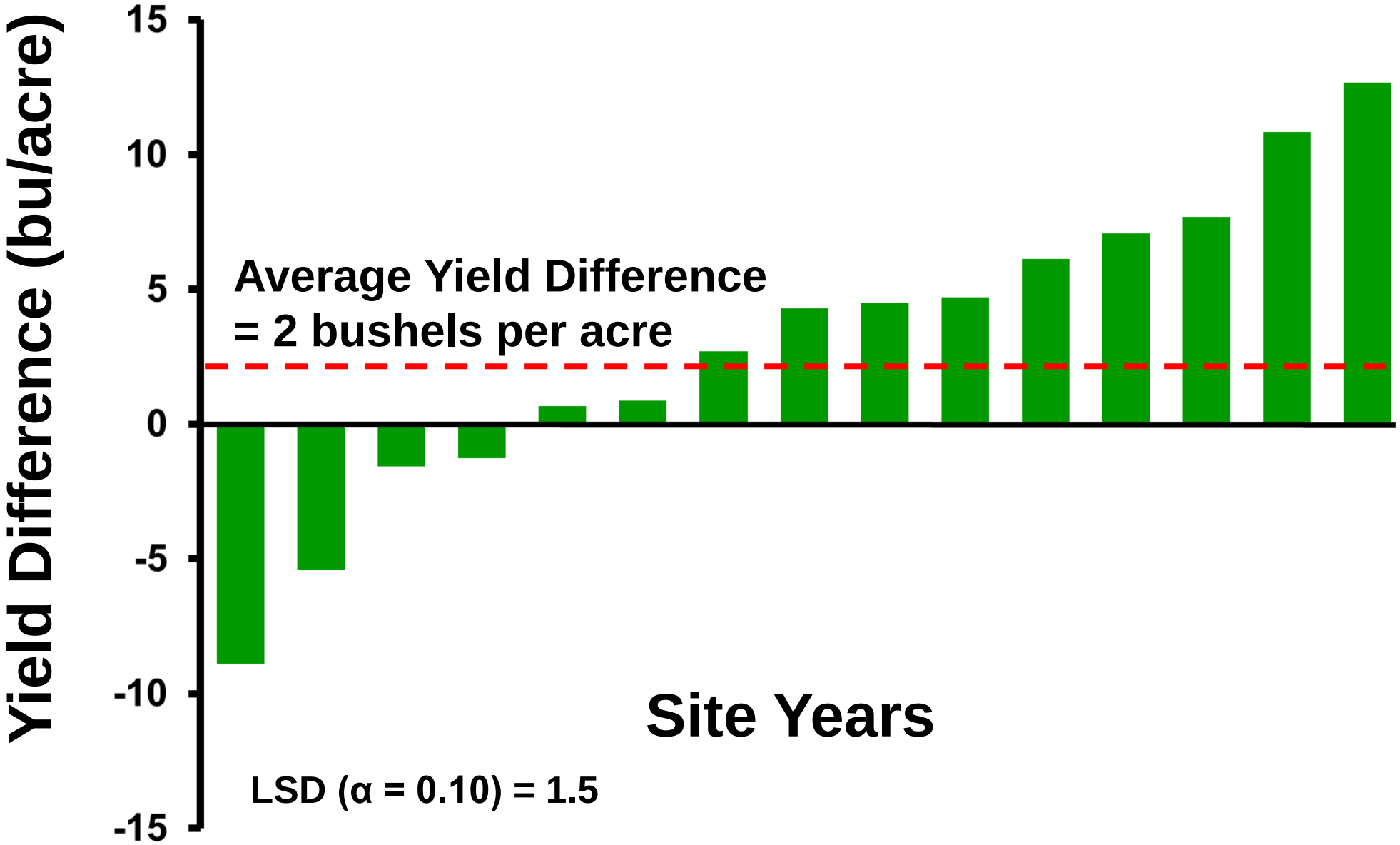
Fertility Plan – Farmer applied normal fertility plan

Treatments – Y-drop N vs Y-drop N + K_2O
at the V5-V9 growth stage
(30 lbs of N and 30 lbs of K_2O per acre)

All soil samples were taken just prior to sidedress application

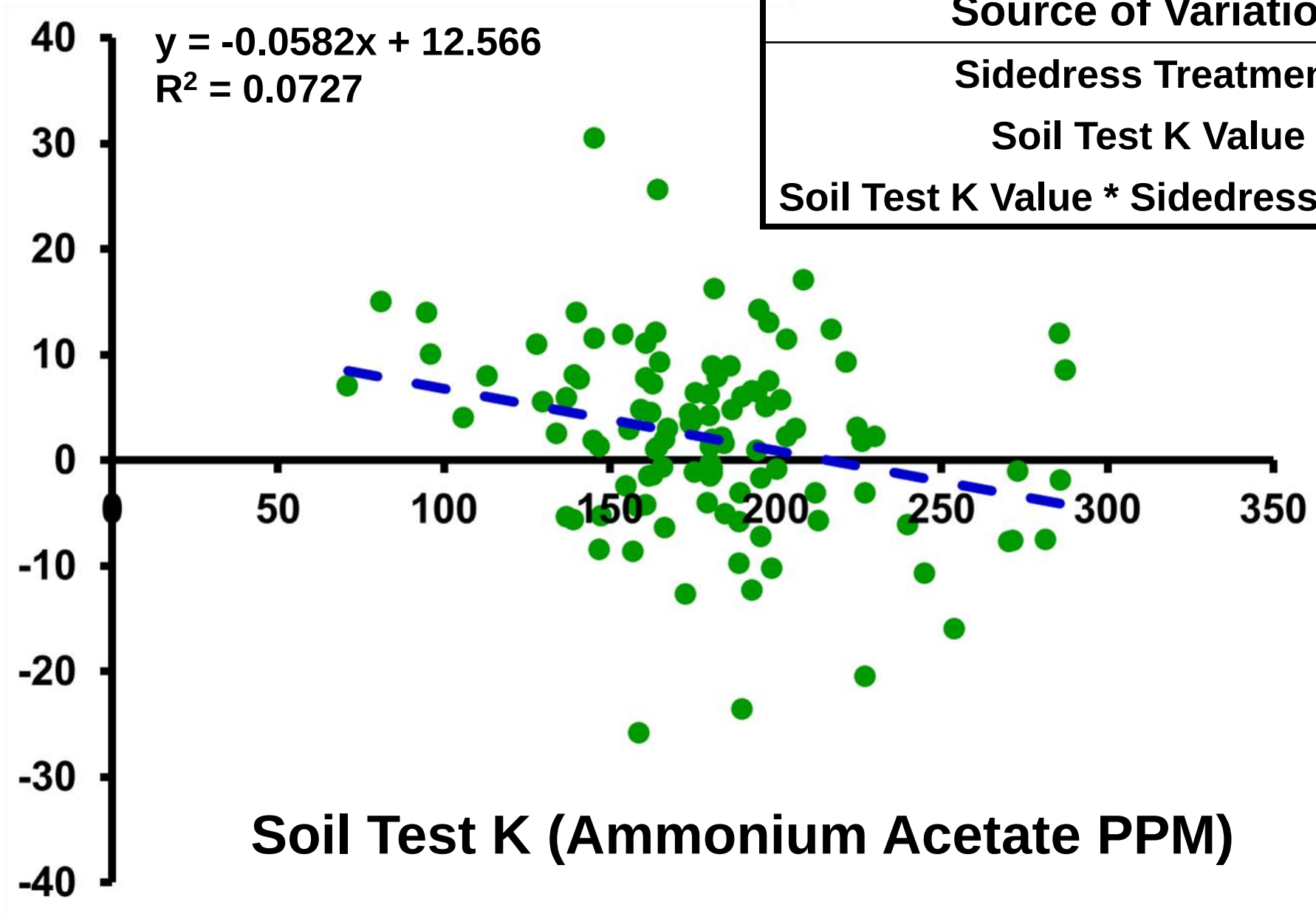
In-season Potassium Application

$N + K_2O$ vs N Yield Difference



$N + K_2O$ vs N Yield Difference

Source of Variation	P-Value
Sidedress Treatment	0.0006
Soil Test K Value	0.8998
Soil Test K Value * Sidedress Treatment	0.0025



Key Takeaways

In-season applications of potassium can increase grain yield, especially when soil test K levels are low

Supporting Research

Dr. Robert Miller from Colorado State University has found similar results when sidedressing potassium in corn.

Dr. Antonio Mallarino from Iowa State University has also found positive results sidedressing potassium in corn when soil test K level are below optimum. However, he also concluded that preplant applications were better than sidedress applications at the same rate.

Future Considerations

1. High Clearance Equipment and Application Technology

2. Short-Statured Hybrids

3. Digital Agriculture and Nutrient Tracking Technologies

Future Considerations

4. Rented Acres
5. Narrower Window for Fall and Spring Fertilizer Applications
6. Nutrient Regulations

Thank You
Fluid Fertilizer Foundation

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