

Effective Nitrogen and Potassium Banding for Corn with Strip Tillage and High-Clearance Applicators

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Research Context:

On-going Experiments with Strip-Till and No-till Corn and Associated Management Options:

1. Nutrient Placement, Rate, Timing, and Source
2. Corn Management (hybrid, plant density, rotation)
3. Greenhouse gas emissions from different 4R N management



Whole-plant, grain, cob and stover nutrient (macro- and micro-) determination at maturity



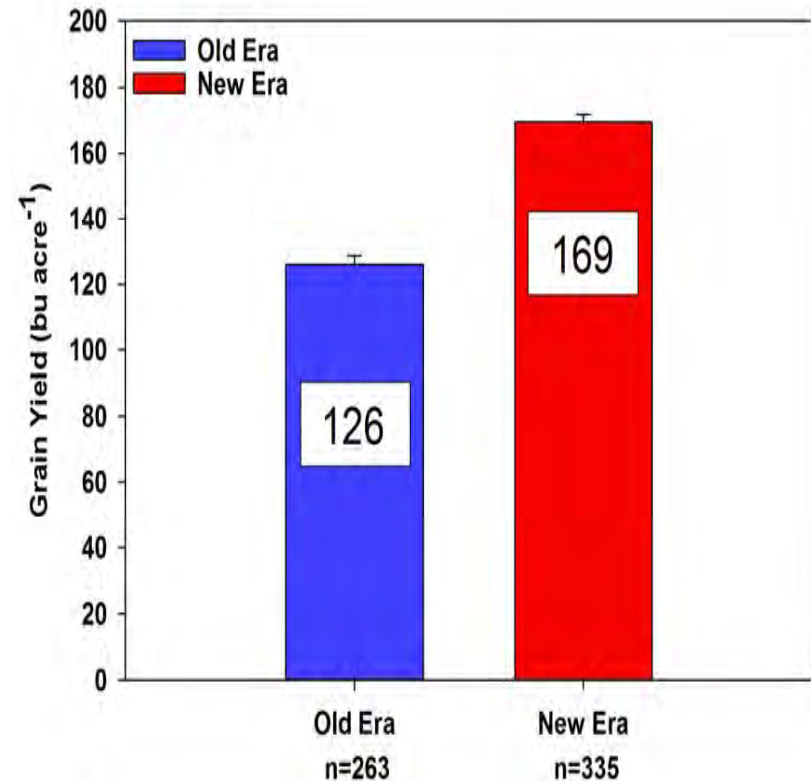
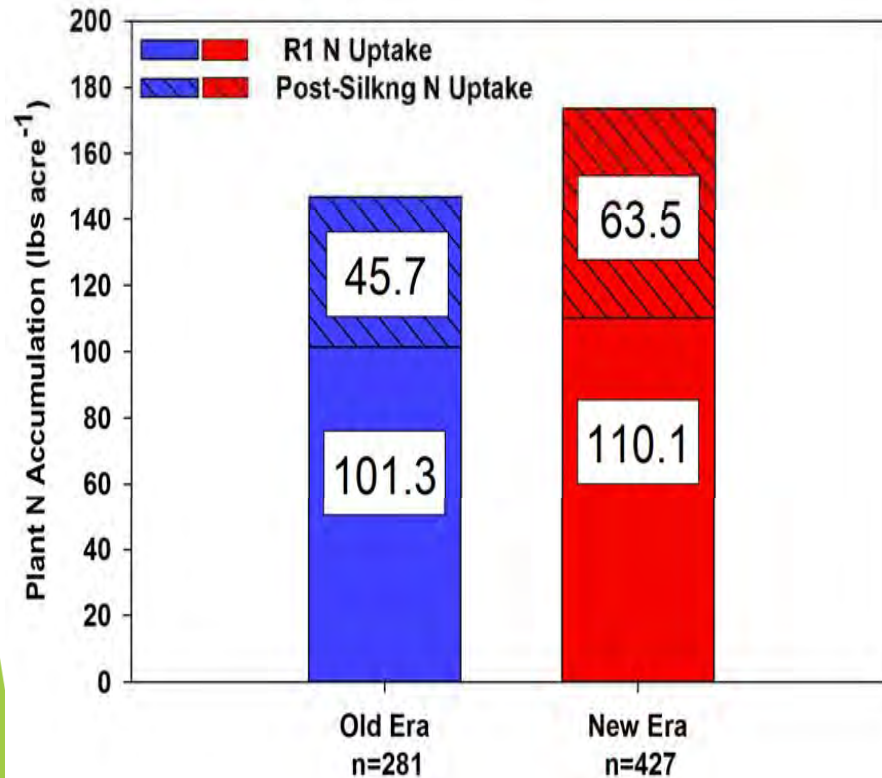
Whole-Plant Corn Analysis at the R1 Stage



1. Sampling from field; 2. Weighting fresh weight; 3. Select five sub-sample and separate sub-samples into leaf, stem (with husk), ear-shoot (R1); 4. Chopping; 5. Bagging; 6. Weighting all fresh weights



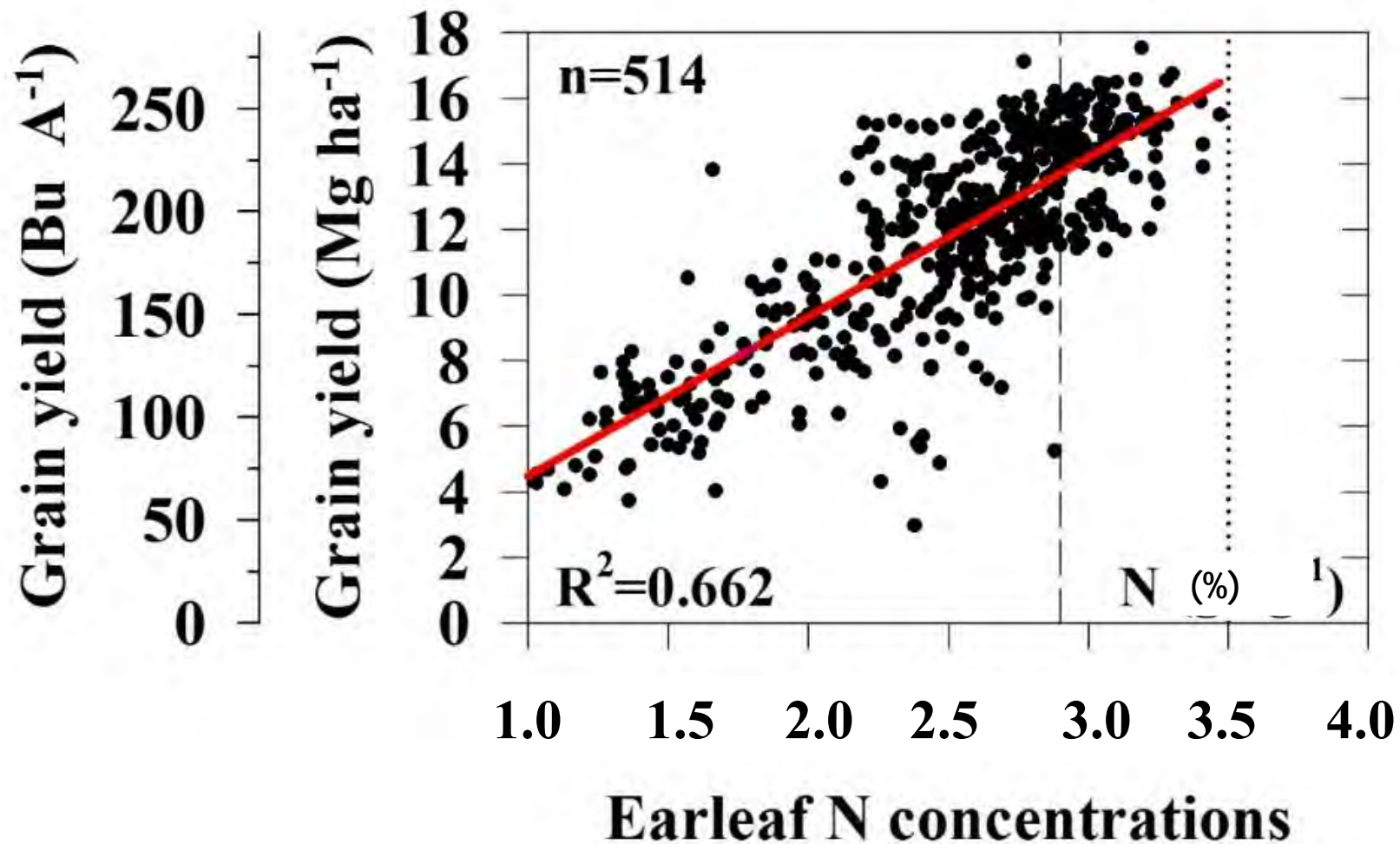
Higher and Later N Uptake in Modern Corn Hybrids



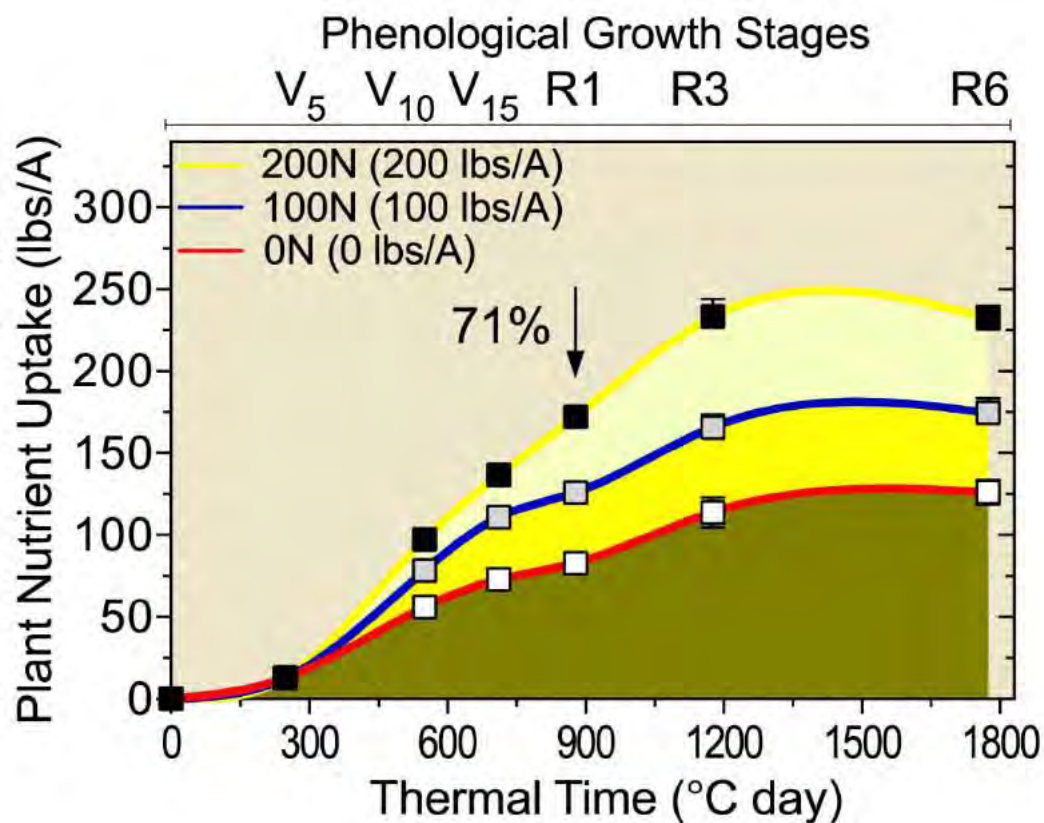
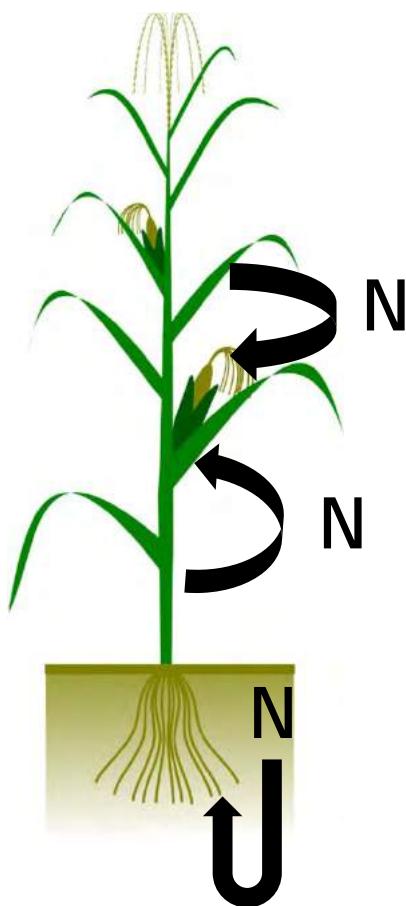
Mean N rates in lbs N acre⁻¹:
151 153

Source: S. M. Mueller and T.J. Vyn 2016 (Frontiers in Plant Science)

Critical Ear-leaf Nitrogen Concentrations (R1 stage) for High Yield Corn (2010-2016)



Timing and Source of N Uptake by Plants and Grain

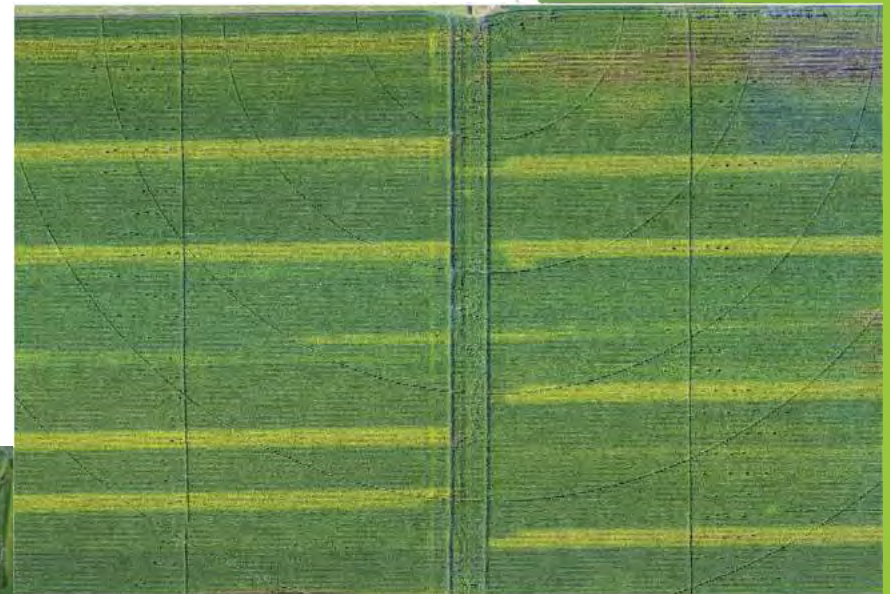


Ciampitti et al., 2013 Agronomy Journal

What About Late-Season N?



UAN applied by Y-Drops (2015-2016)



Late-Split N Applications with Older versus “Modern” Pioneer Hybrids (2014-2016)



Methodology

Main Treatment:
N rates

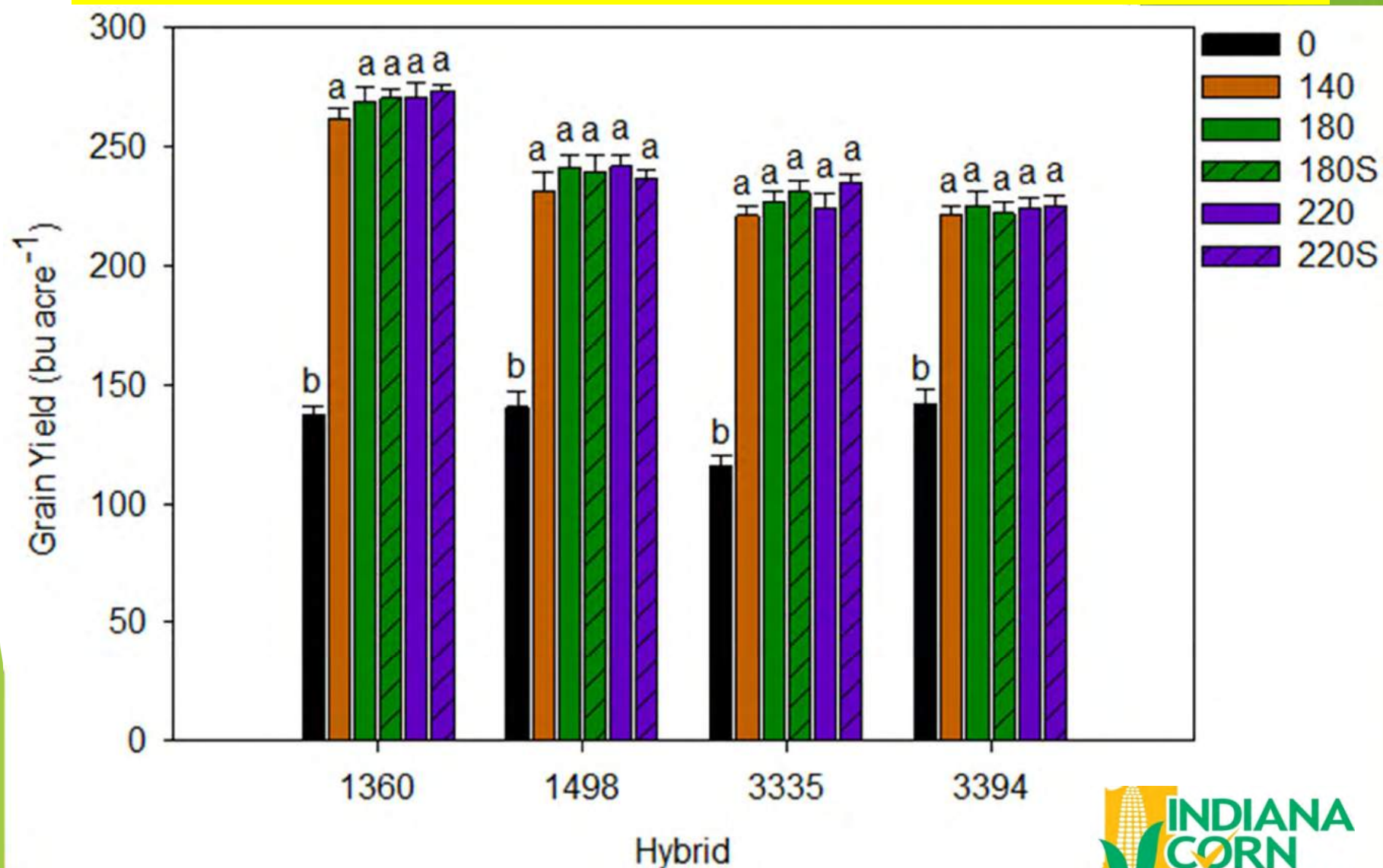
Treat. Name	Lbs N V3-V4	Lbs N V12-V14
0	0	
140	140	
180	180	
220	220	
180S	140	40
220S	180	40

Sub-Treatment:
Hybrid (Release year)

1. Pioneer 3394 (1991)
2. Pioneer 3335 (1995)
3. Pioneer 1498 HR (2012)
4. Pioneer 1360 HR (2014)



Corn Grain Yields After Late-Split N Applications Wanatah, IN, (2014-2015)



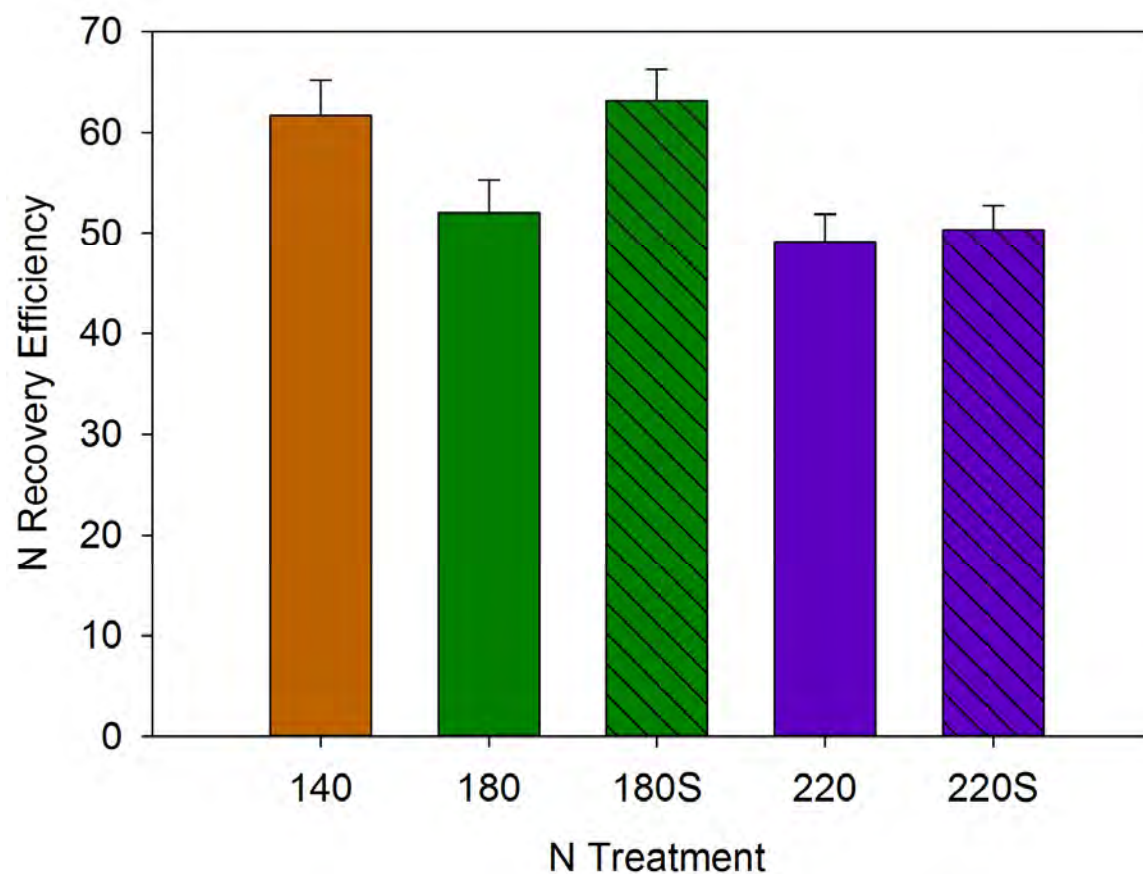
Source: Mueller et al., Agron. J., 2017





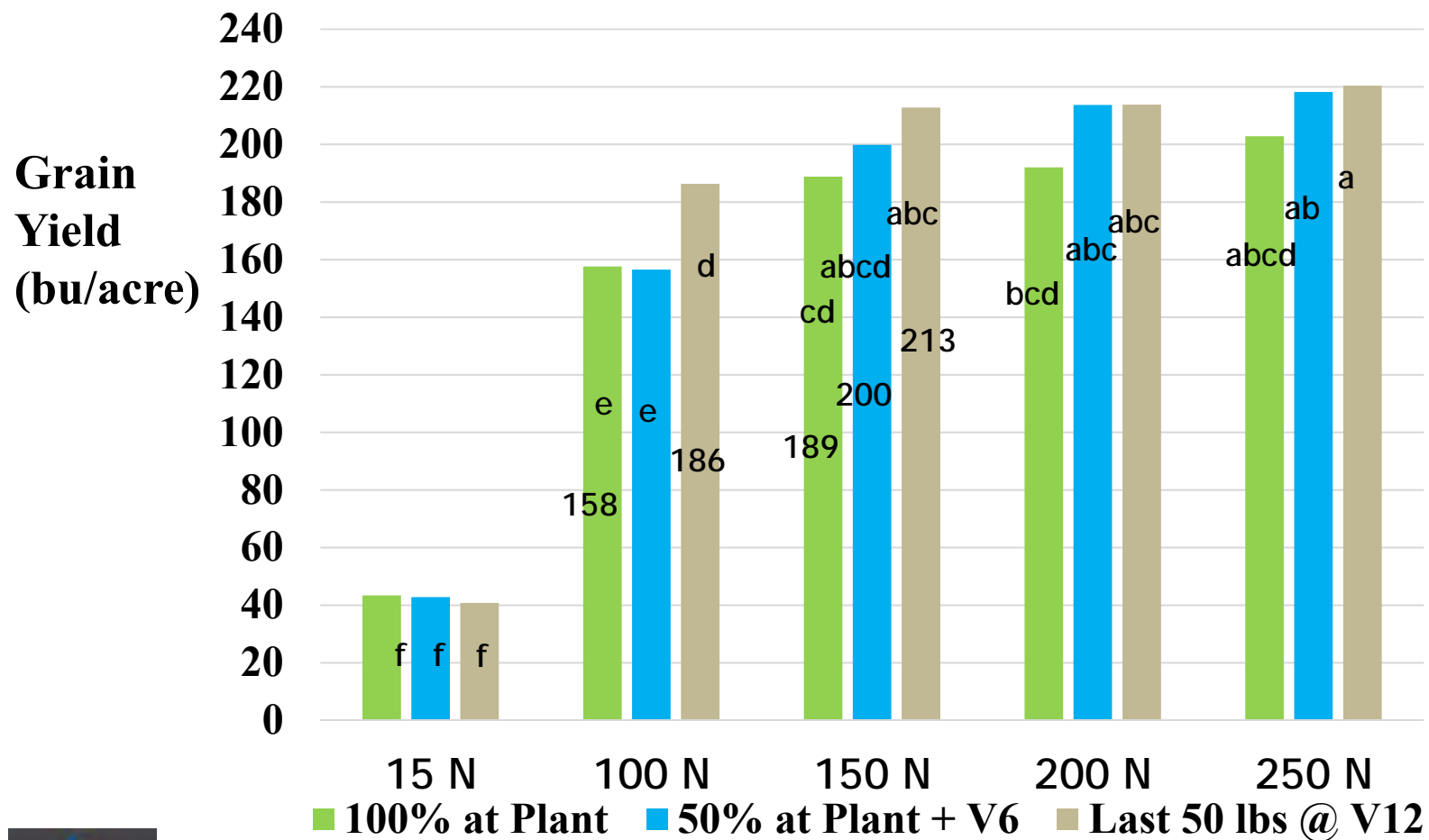
Corn N Recovery Responses to Late-Split N in 2014-2016

**N Fertilizer
Recovery (%)**



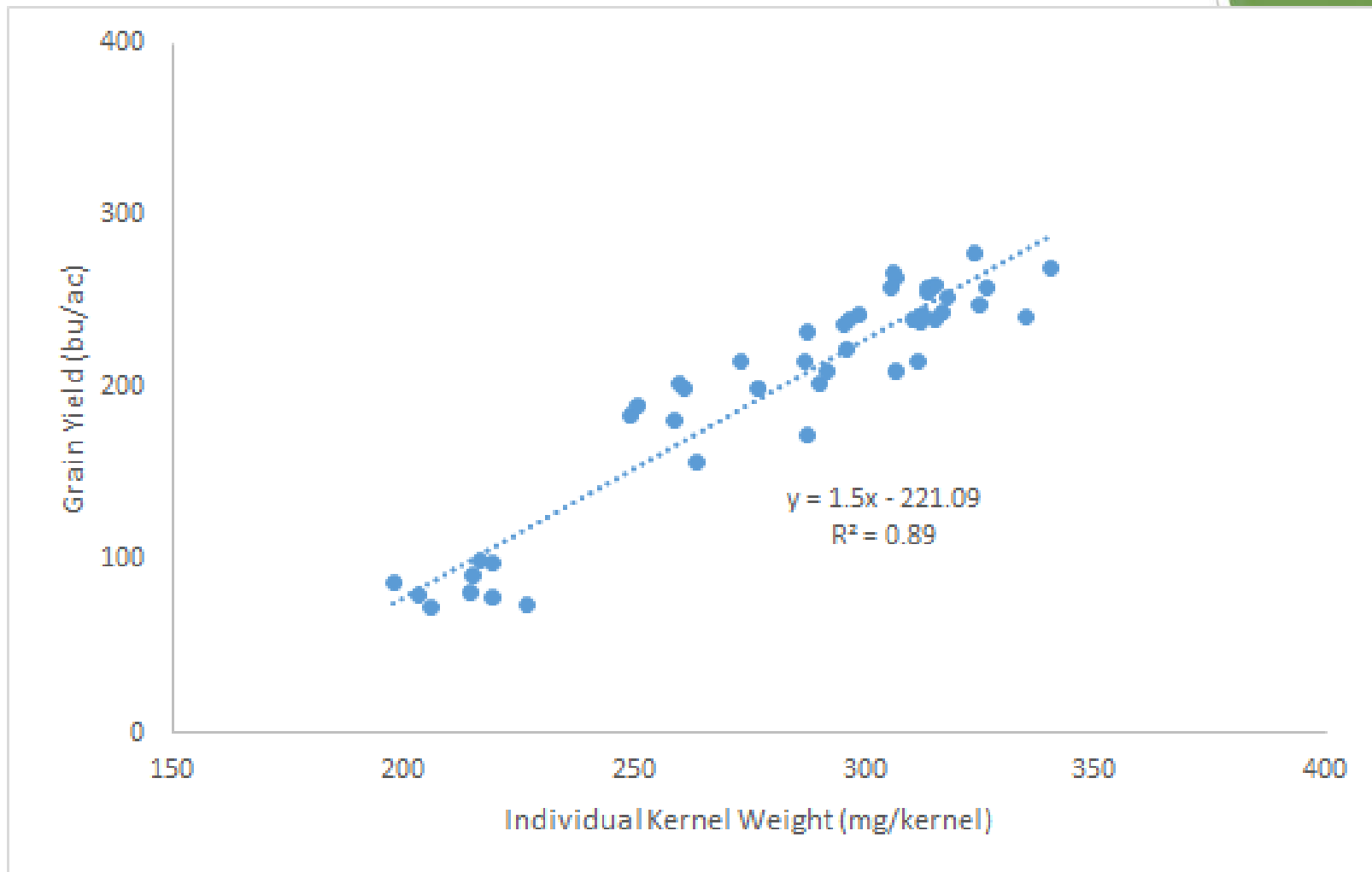
S.M. Mueller et al., Agronomy Journal, 2017
Average of 4 hybrids

Nitrogen Timing in Continuous Corn on Irrigated Sandy Soil (LaCrosse, IN) with DKC66-42 in 2016



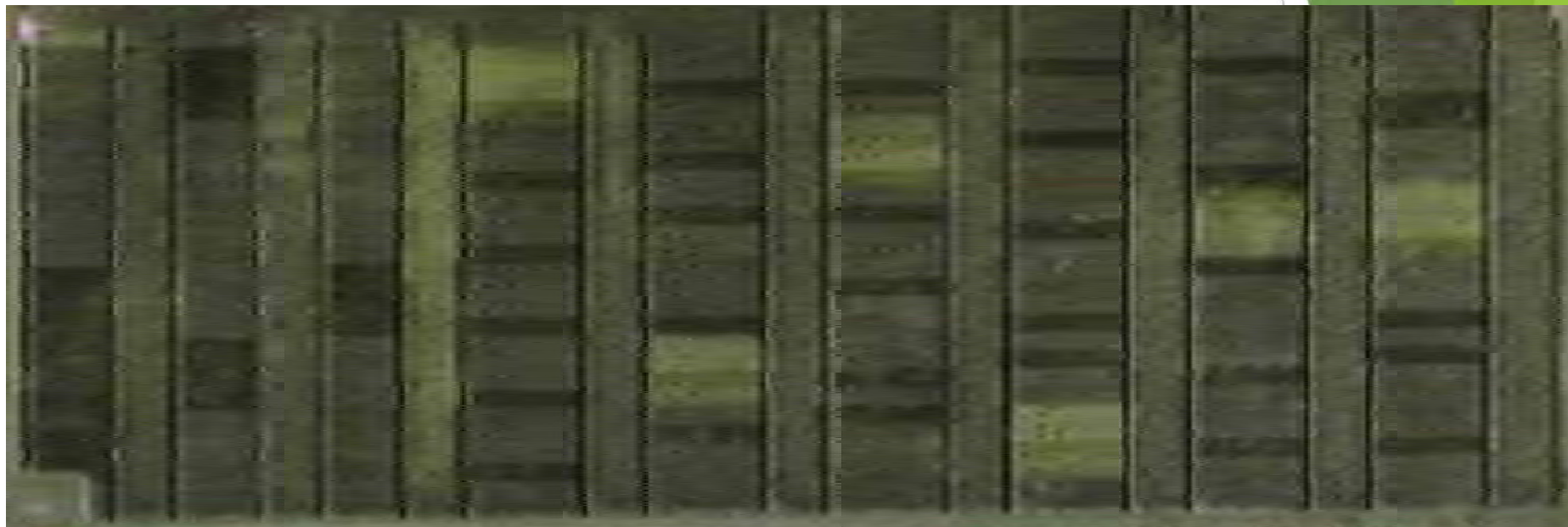
Source: Lia Olmedo Pico and T. Vyn, 2016

Corn Yield Dependency on Kernel Weights in 2017 across the N Rate and Timing Treatments

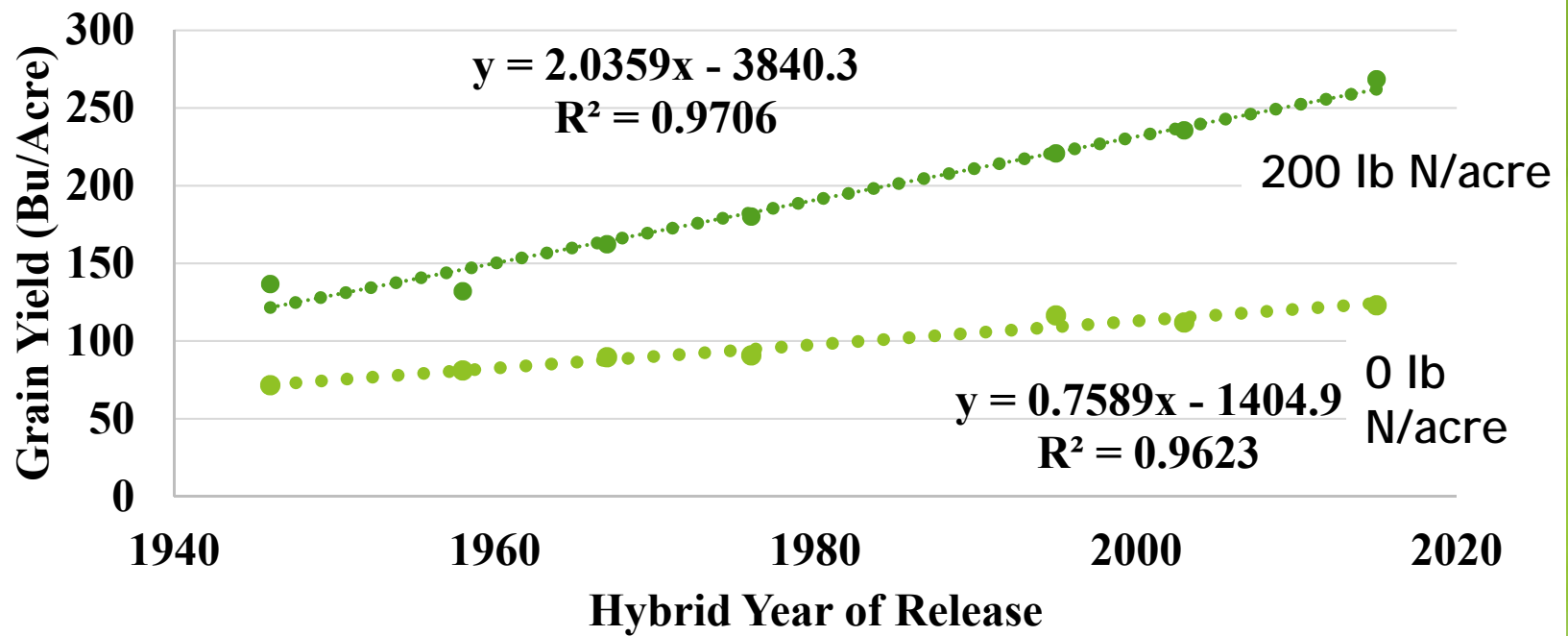


Source: Lia Olmedo Pico and Tony Vyn, unpublished, 2017

Hybrid Recovery of Late-Season N Applications?

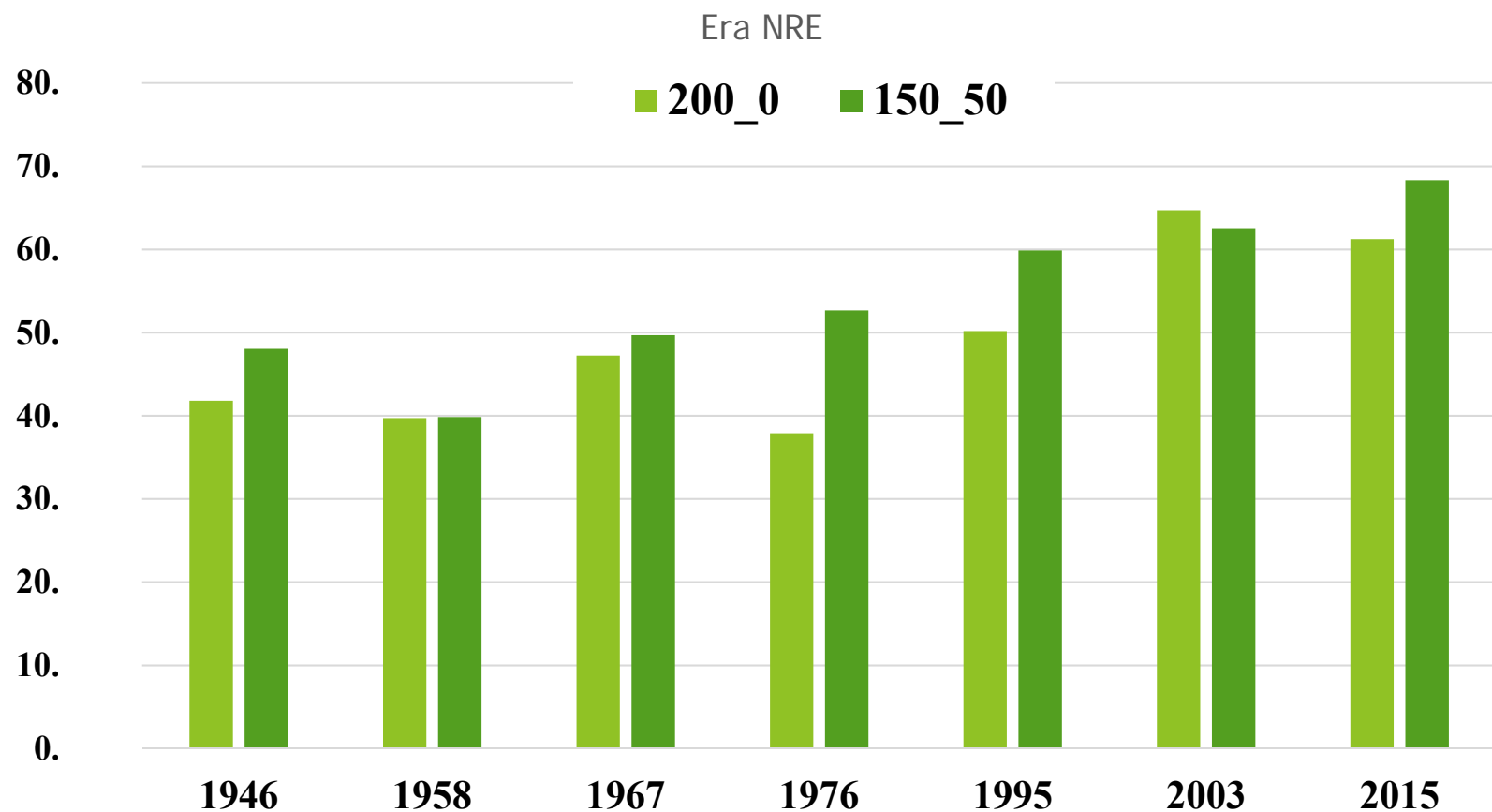


Grain Yield Response to N Rate with Pioneer Era Hybrids (average of 2016-2017)



Source: Mueller and Vyn, unpublished, 2017

Nitrogen Recovery Efficiency with Pioneer Era Hybrids (Two N timing treatments; 2016 only)

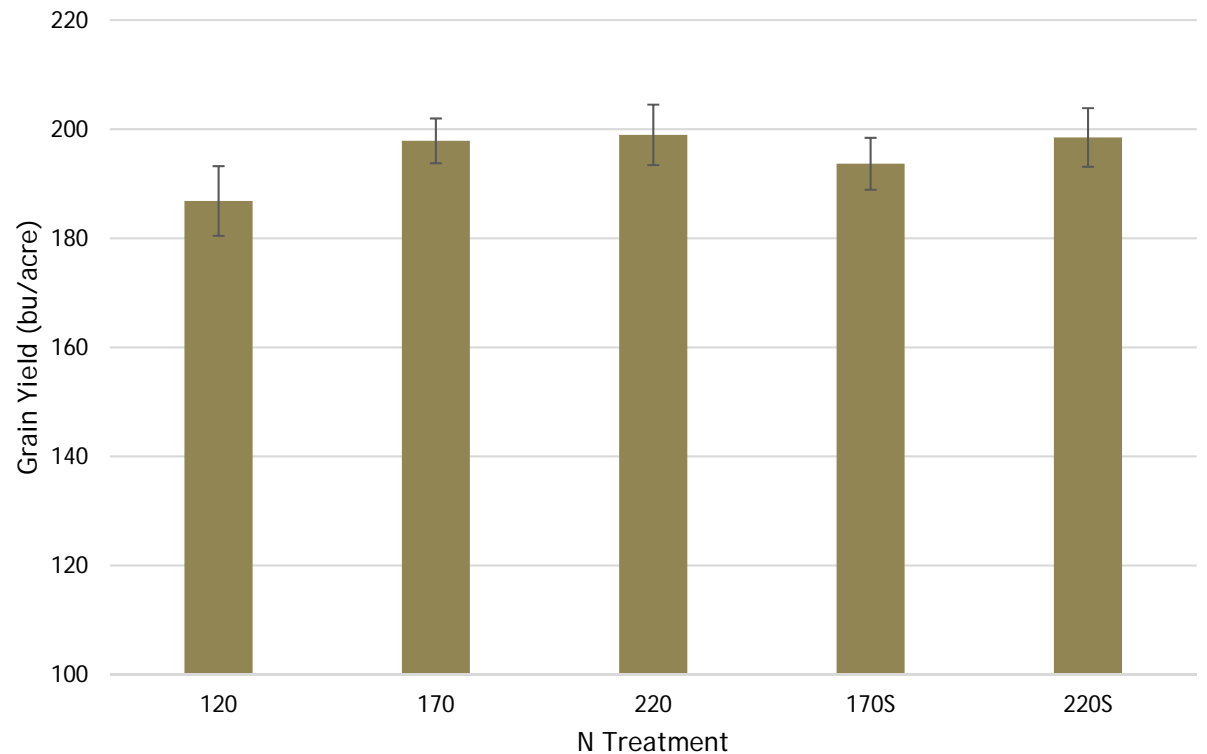


Source: Mueller and Vyn, unpublished, 2017

On-farm Studies with Intentional Late-Season N applications of 30 to 50 pounds



Practical Methods to Apply Late-Season N



Farm Cooperators:
Mike Shuter and Aaron Howell



2017 Equipment Option Focus: Side-dress Nitrogen Timing and Placement

1. At-plant (zero vs. 77 and 177 pounds per acre; all broadcast)
2. At-plant 77 pounds/acre plus V5 @ 80 pounds (Y-Drop vs. Coulter)
3. At-plant 77 pounds/acre plus V8 urea + Agrotain (broadcast)
4. At-plant 77 pounds/acre plus V12 @ 80 pounds (Y-Drop vs. Coulter)

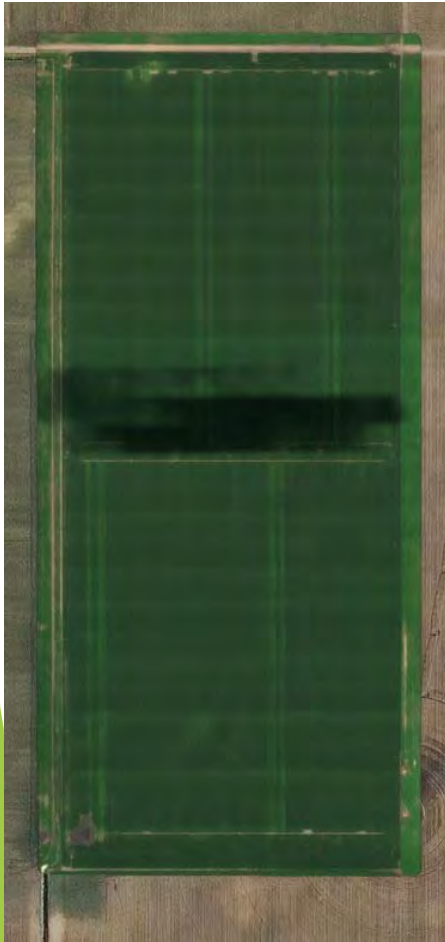


Broadcast Urea + Agrotain at V-8

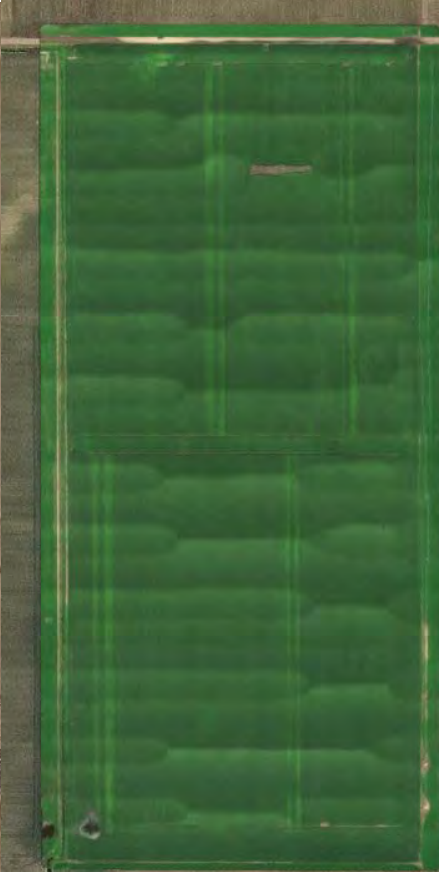


Corn Side-dress N Experiment 2017

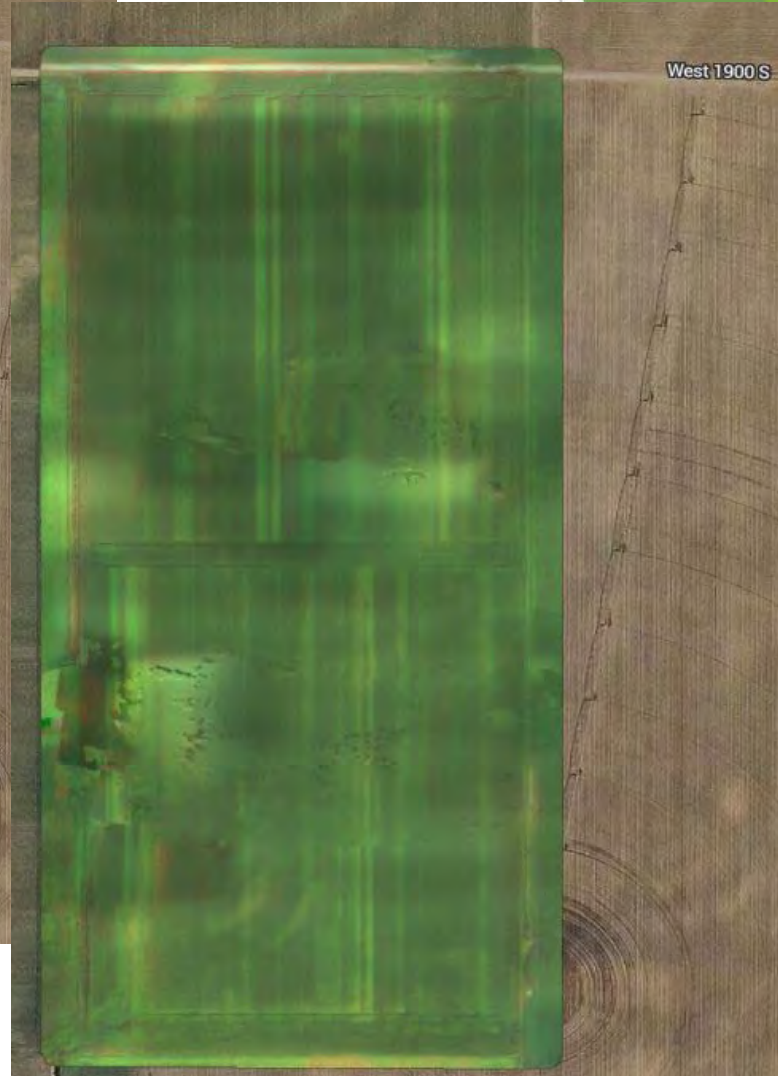
July 17



July 25



September 8



Corn Yield Response from Sidedress N Trial in 2017 (LaCrosse, IN; sandy loam soil)

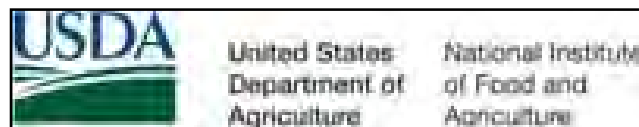
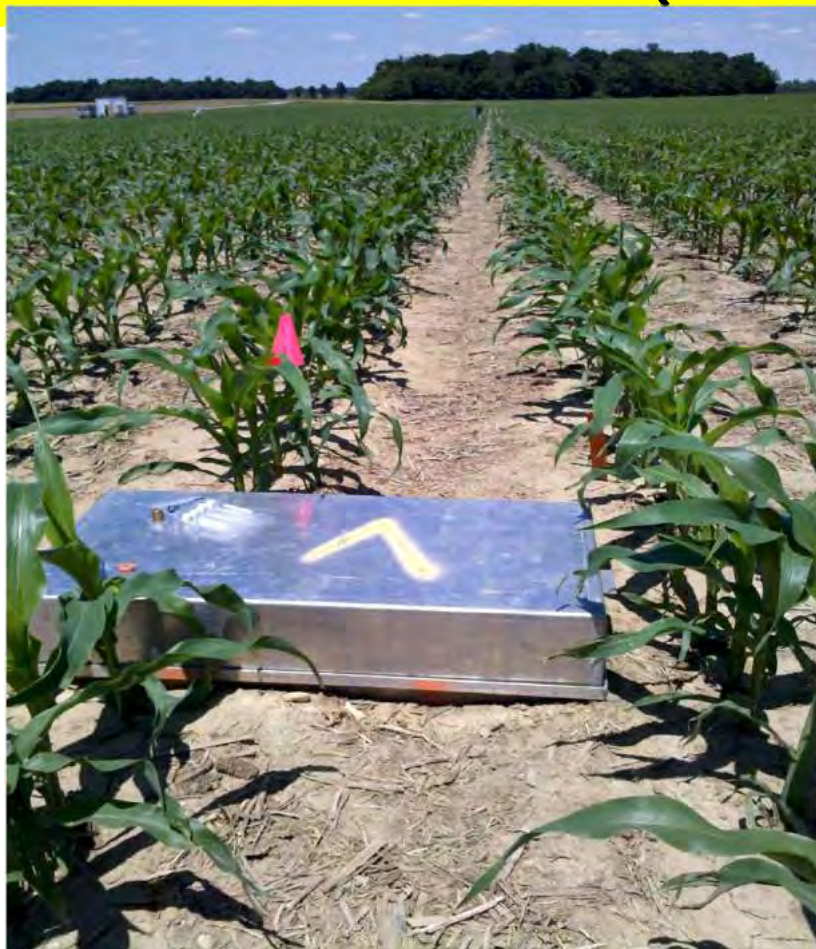
Nitrogen Rate and Timing	Total N (lbs/acre)	Yield (bu/acre)	% Fert. N Recovery
Zero N except a common starter (19-17-0)	23	120 e	-
At-plant broadcast UAN (50%) + nothing	100	190 d	56
At-plant broadcast UAN + nothing	200	231 a	50
At-plant UAN (50%) + Y-Drop UAN (50%) at V5	180	227 ab	59
At-plant UAN (50%) + Coulter UAN (50%) at V5	180	221 bc	61
At-plant UAN (50%) + Urea Agrotain (50%) at V8	180	217 c	59
At-plant UAN (50%) + Y-Drop UAN (50%) at V12	180	229 a	66
At-plant UAN (50%) + Coulter UAN (50%) at V12	180	215 c	53



Source: Vyn, Thompson, West, 2017



Sidedress UAN and Instinct™ Application (2010-2016)



The Choice!

Pre-Plant



Early Sidedress



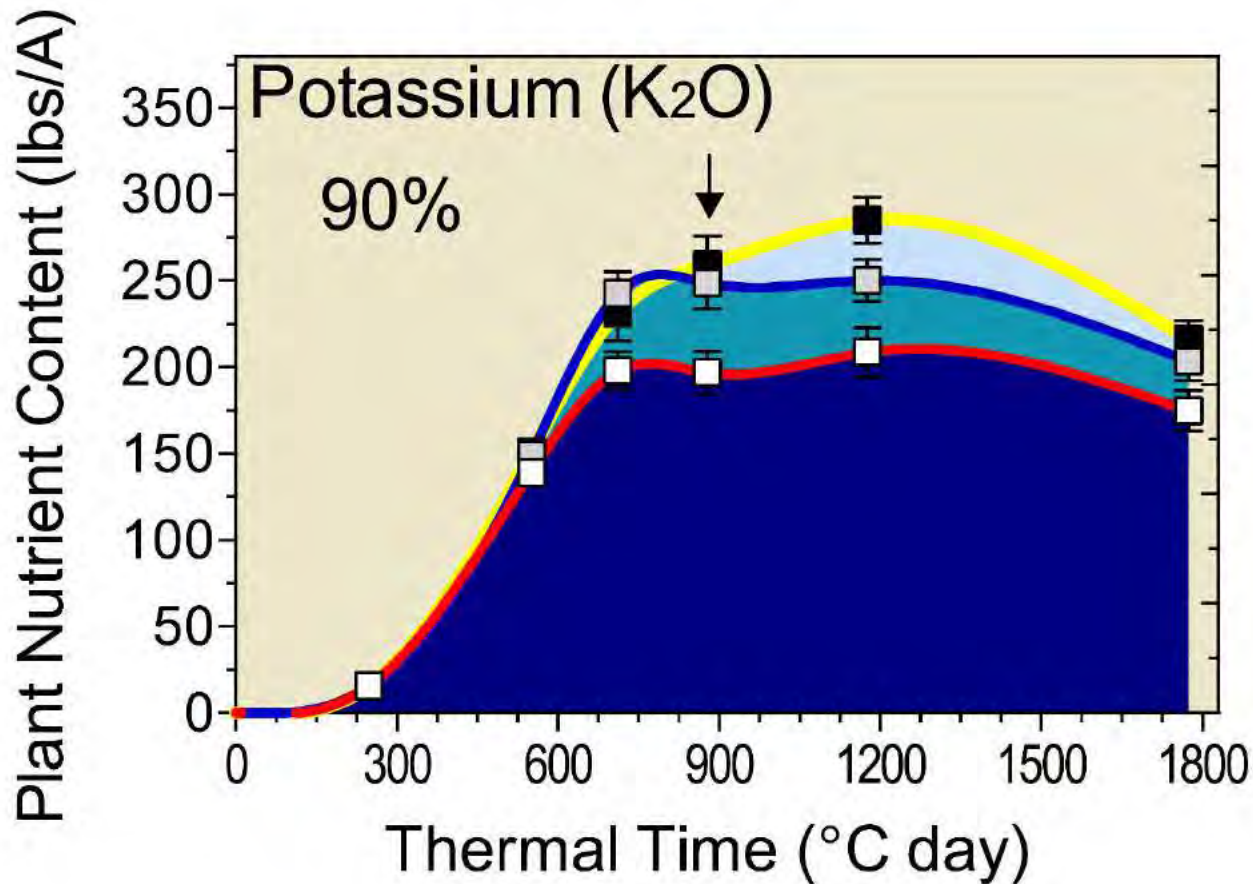
Late Sidedress
as a Supplement



Strip Tillage and Nutrient Placement Research

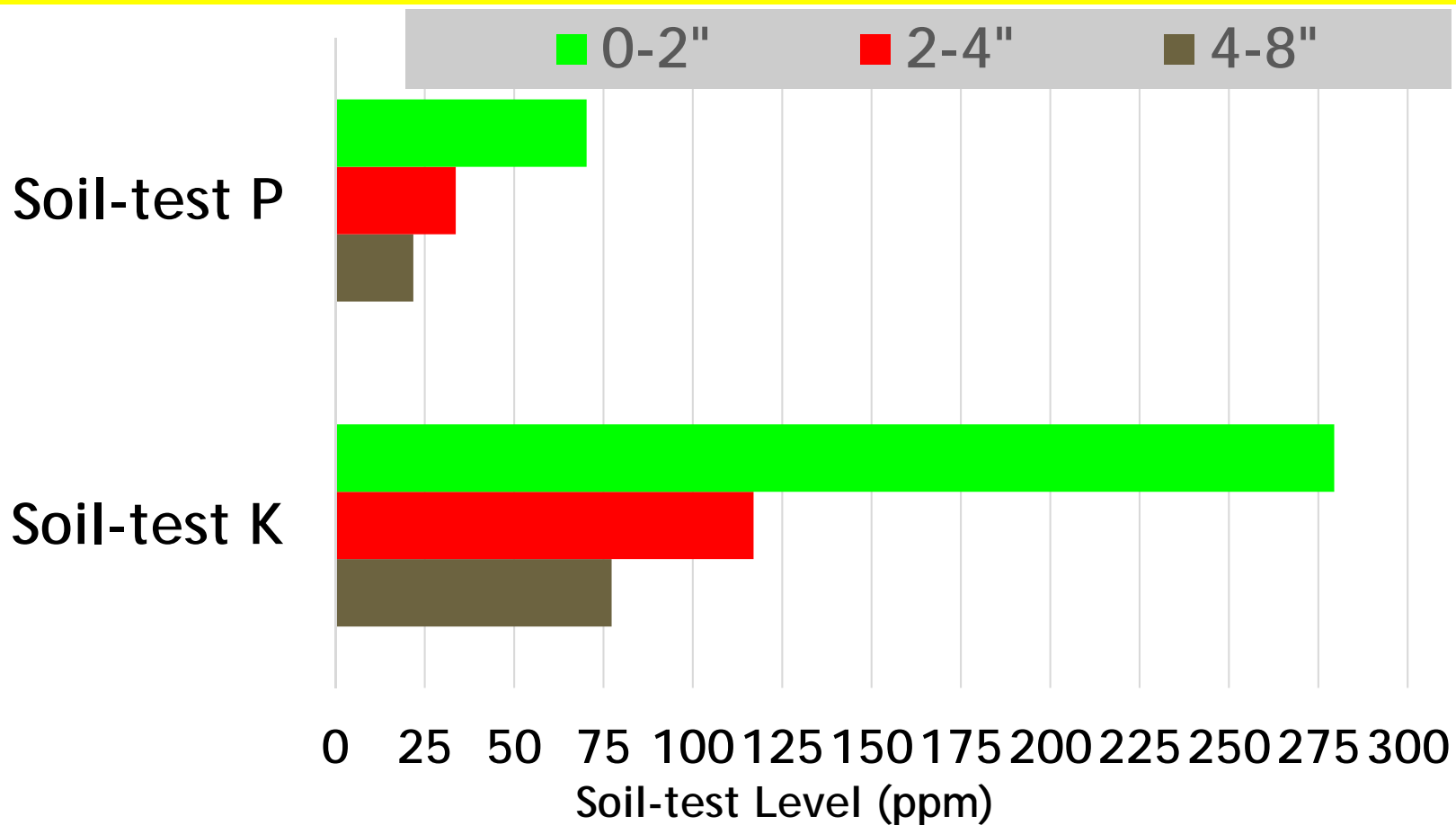


Potassium Uptake in Growing Season Over Time in Corn at Three N Rates



Ciampitti et al., 2013 Agronomy Journal

Stratification for P and K in Strip-till Corn and No-till Soybean Rotation with only Starter P (corn) and no Broadcast P or K in 4 Years

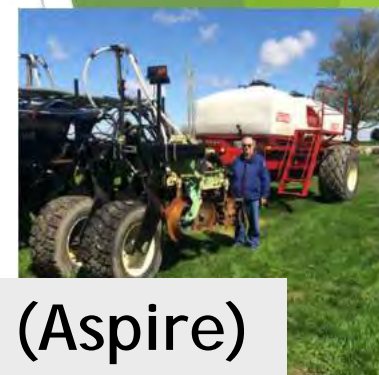


Source: Vyn, Global Maize Trial, West Lafayette, 2014

Indiana Corn Yield Responses to K₂O Placement and Timing



Tillage System	K ₂ O timing	Aspire K product rate (lb/acre)	2016 yield (bu/acre)	2017 yield (bu/acre)	2-year Mean 2016-2017 (bu/acre)
No-till	NA	0	225 de	239 cd	232 ef
No-till	Spring	200	226 de	252 abc	238 bcde



More Yield Gains Possible from Potash Fertilizer (Aspire) with strip-till than with chisel or no-till

Spring Strip-till	NA	0	220 e	236 d	227 f
Spring Strip-till	Spring	100	231 bcd	257 a	242 abcd
Spring Strip-till	Spring	200	233 abc	260 a	245 ab
Fall Chisel	NA	0	229 cd	246 abcd	236 cde
Fall Chisel	Fall	200	239 a	254 abc	245 ab

Soil-Test K mean: 214 ppm. 110 ppm.

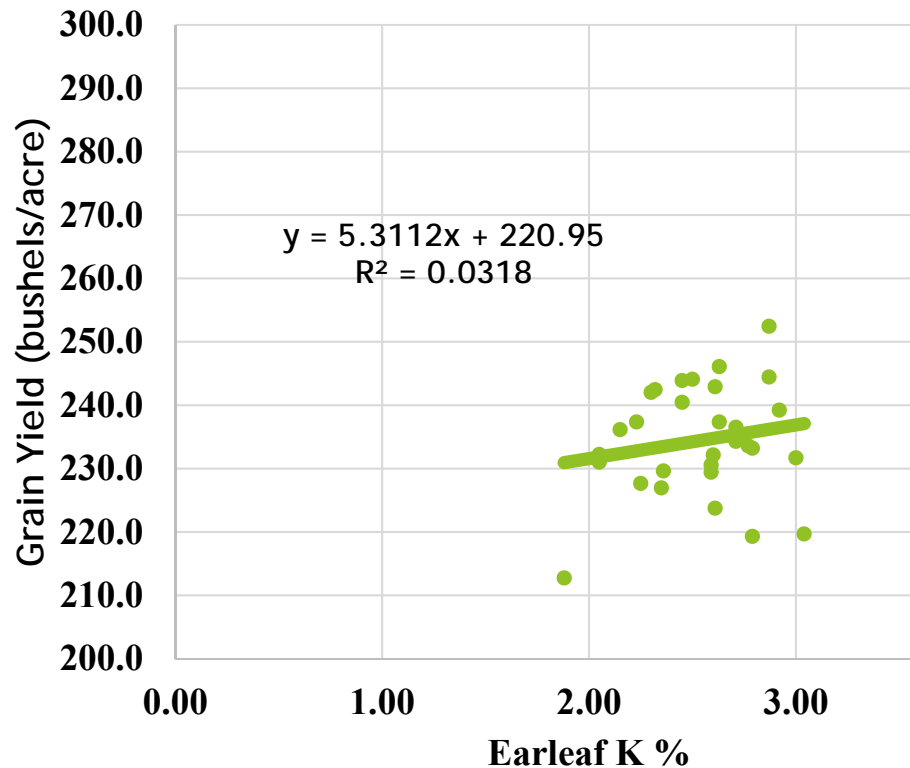
Mean Yield Gain with 200 rate. 8 bu. 15 bu

Source: Vyn, 2017, Unpublished

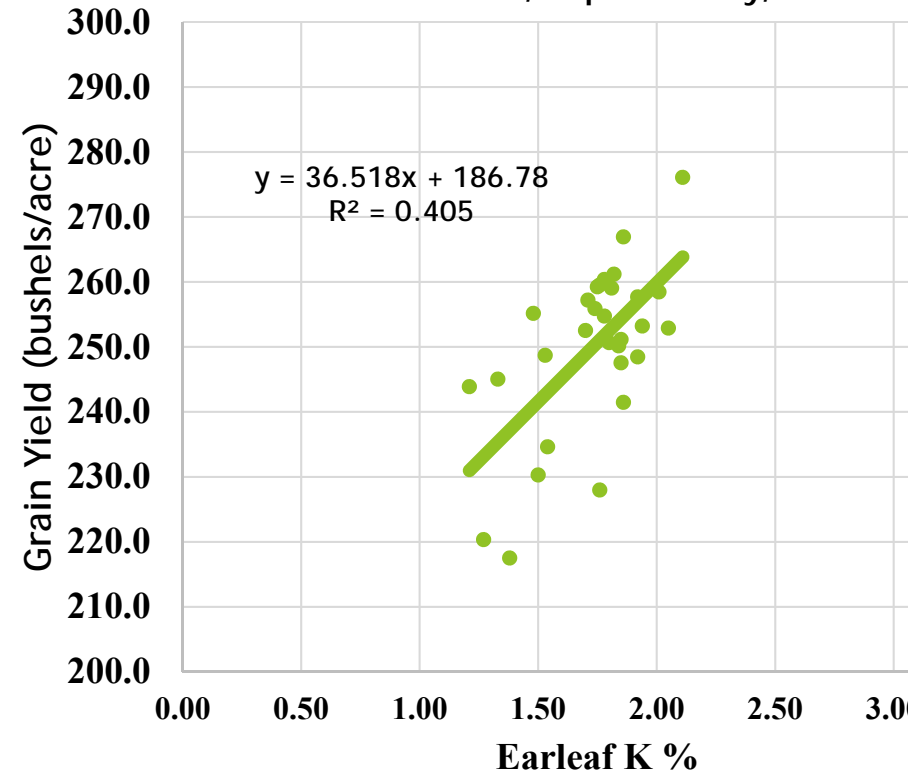


Ear-leaf K Concentration Relation to Final Yield in Indiana Experiments (2016-2017)

Earleaf K 2016, Aspire Study, ACRE

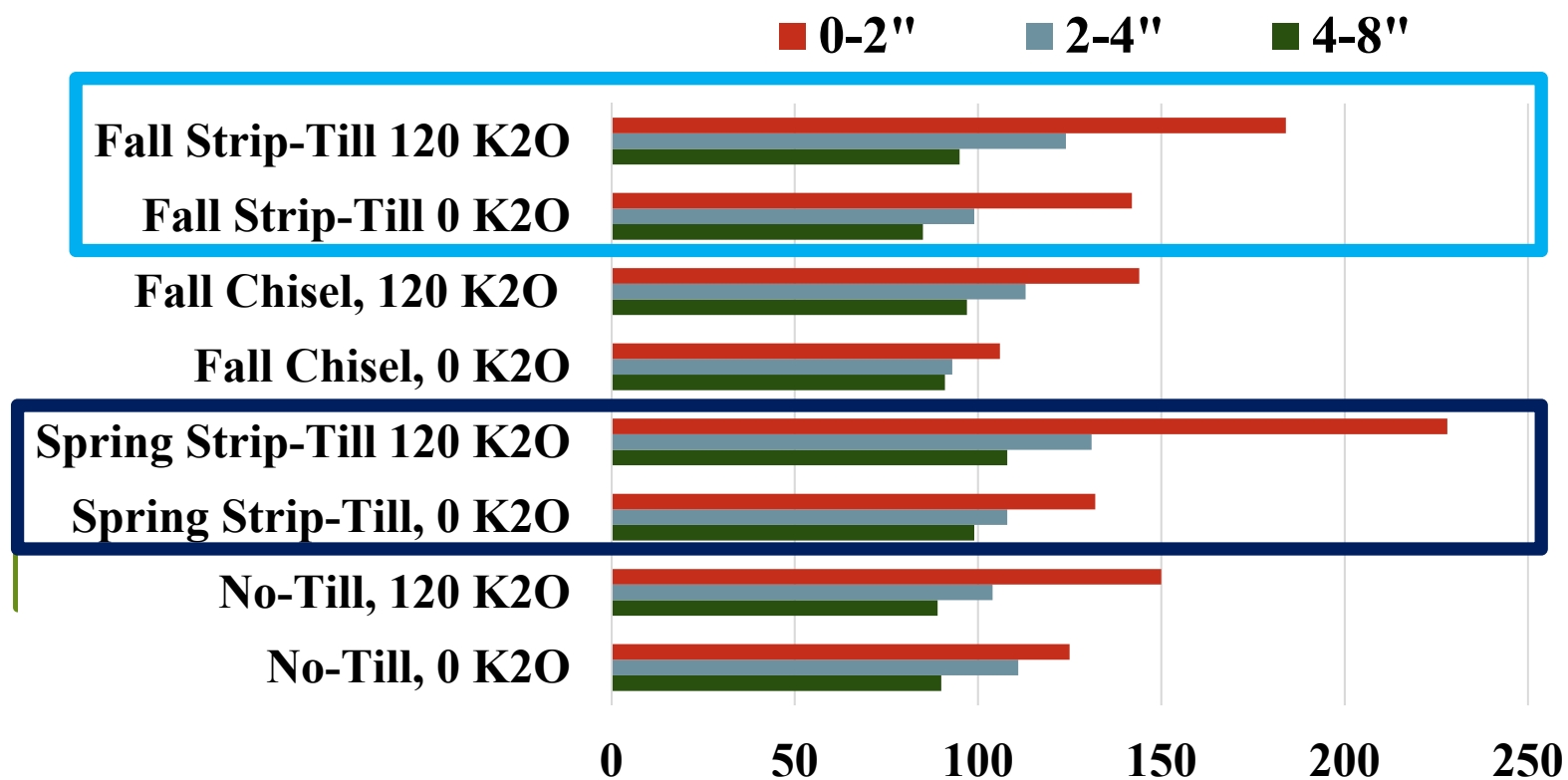


Earleaf K 2017, Aspire Study, ACRE



Source: Vyn, 2017, unpublished

Tillage and K₂O Rate Consequences for In-row Soil-test K at 3 depth increments (West Lafayette, IN, 2017)



Source: Vyn, 2017, unpublished
K Source: Aspire (58% K₂O, 0.5% B)



Cautions on Spring Banding of N plus K_2O

When: How close to planting time and rainfall timing?

Where: Separation from the seed row and soil texture?

Source: urea/ammonium?

Rate: Less than 150 pounds/acre of actual N plus K_2O has less injury potential

Conclusions

- **Modern hybrids take up more total N at the same N rates, and more post-silking than old hybrids, so there could be more yield and N efficiencies to gain with late-split N.**
- **Late-split N hasn't often increased grain yield compared to all N applied at normal side-dress in Indiana corn-soybean situations, but it has consistently increased plant N recovery efficiency. It also permits N rate in-season N rate flexibility and an opportunity to reduce total N rates.**
- **More rate/timing etc. research needed multiple-position nutrient placement to increase nutrient availability over the critical uptake periods and address stratification issues.**

Acknowledgments

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- Dupon
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Seed:

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Monsant
Dow Agros





► Thank you!