



Efficient Management of Water and Nutrient Resources: Assessing the Potential for Drip Irrigation Fertigation

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Test Your Knowledge of High Yield Corn

- What is the world record corn yield and what is the corn yield gap?

The Corn Yield Gap

- US average yield of 175 bushels per acre
- All 18 NCGA contest winners in 2016 exceeded 300, 5 exceeded 400, and 2 exceeded 500 bushels
- World Record of 532.0271 bushels per acre in 2015

2016 National Corn Growers Contest Winners

Top Ten Yields and Locations

Randy Dowdy, Georgia @ 521.4

Kevin Dowdy, Georgia @ 501.0

David Hula, Virginia @ 485.0

Michelle Dowdy, Georgia @ 465.0

Loren Seabolt, Georgia @ 463.1

Health Cutrell, Virginia @ 347.2

Dan Gause, South Carolina @ 346.0

Daniel Gause, South Carolina @ 345.3

Kristen Corpus, Oregon @ 339.6

William Thomas, South Carolina @ 336.5

Highest Yields with Irrigation

2016 National Corn Growers Contest Winners Winners From I States

Kevin Kalb, Indiana @ 339.0

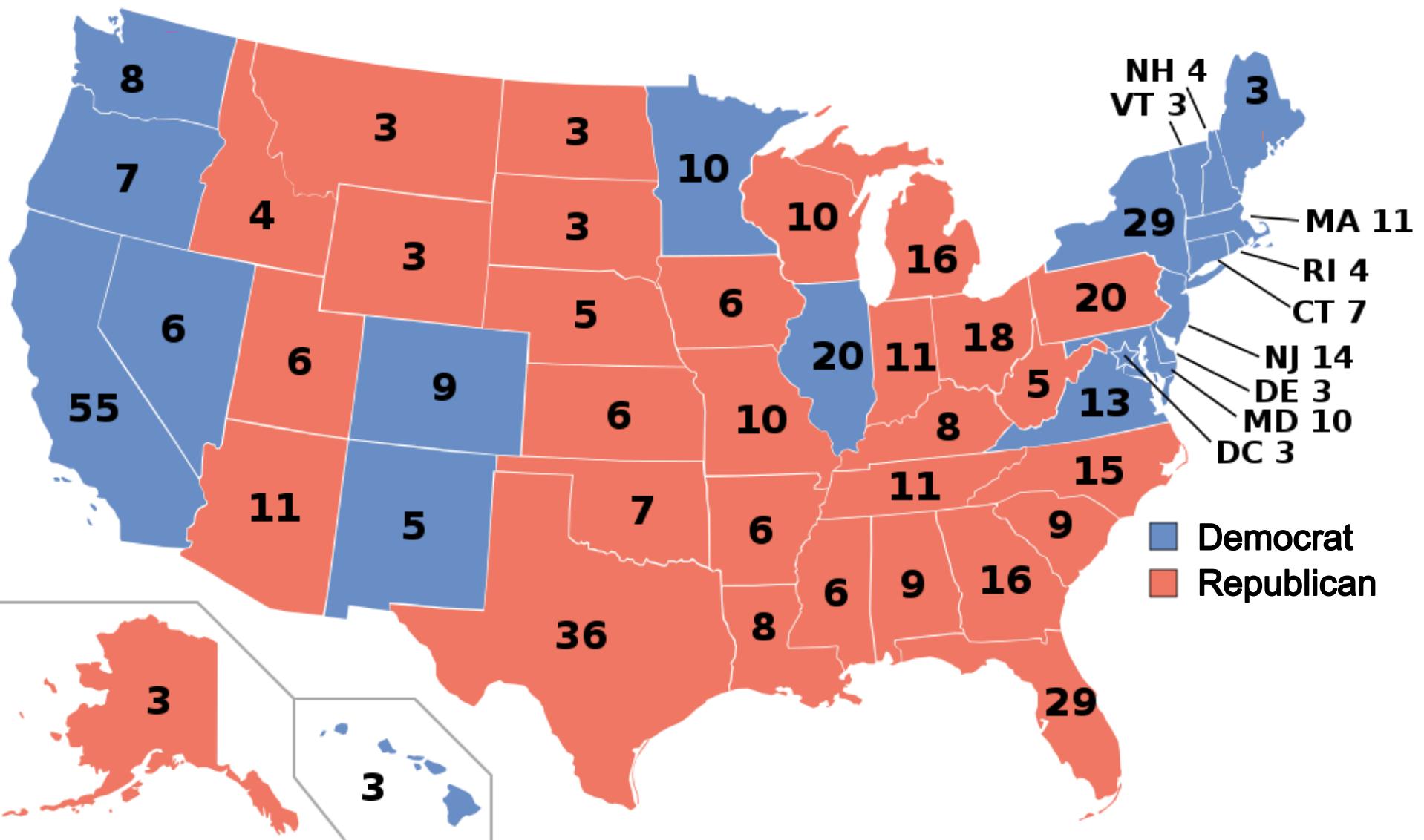
Tim, Dan & Joe Durick, Iowa @ 333.5

Robert Jensen, Iowa @ 332.7

Patrick Hammes, Iowa @ 320.3

John Ruff, Iowa @ 313.3

Illinois is a Blue State



President Trump Likes Corn



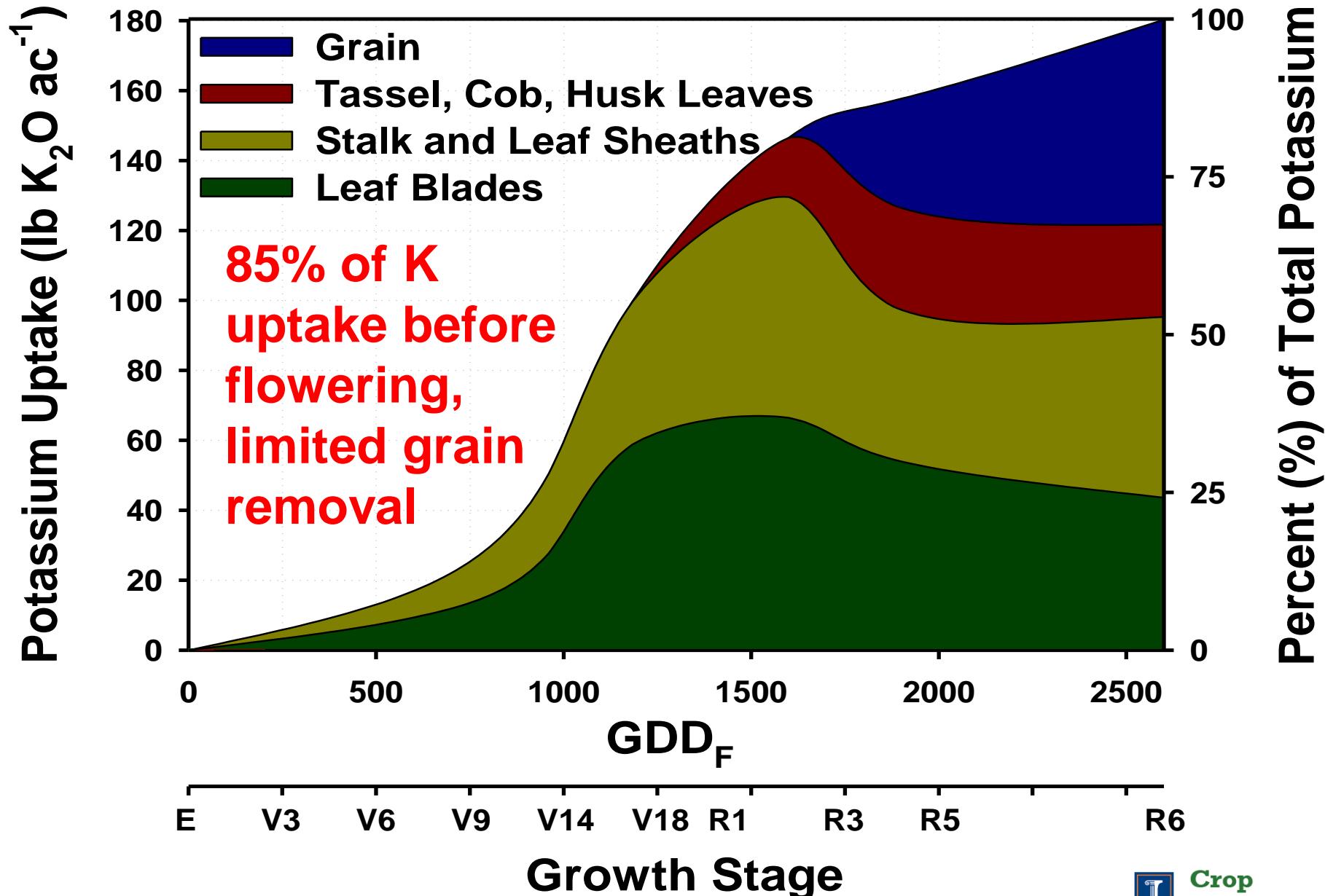
Strategy for Winning the Corn Yield Contest

- Feed (better plant nutrition) and protect a much higher density of plants of the best ‘racehorse’ hybrids
- Make sure the crop is never stressed

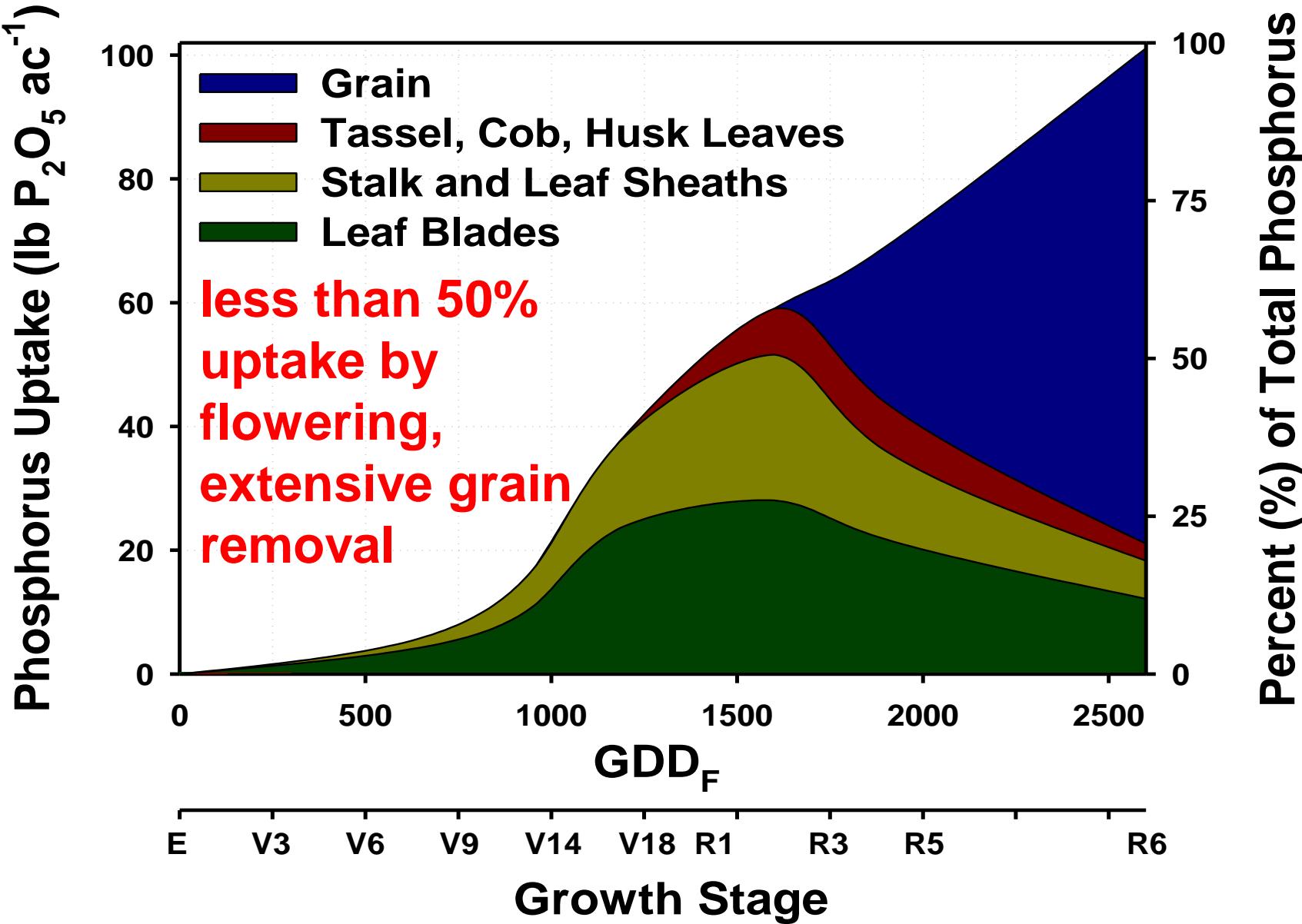
Test Your Knowledge of High Yield Corn

- Are all mineral nutrients absorbed in the same amounts, at the same time, and used in the same way?

K Uptake & Partitioning for 230 Bushel Corn



P Uptake & Partitioning for 230 Bushel Corn



Research Objectives



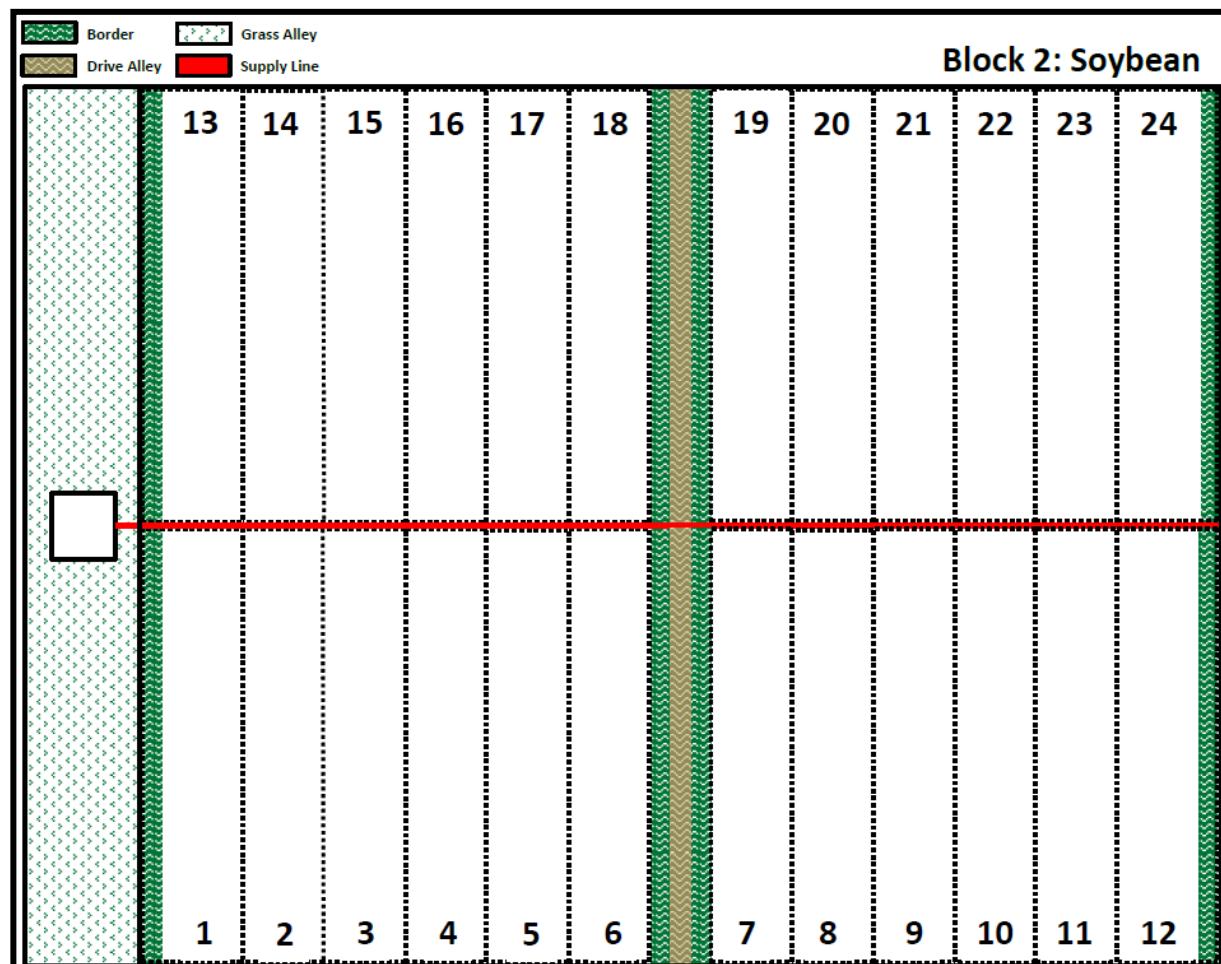
Can we use subsurface
drip irrigation provide
in-season nutrient
availability and alleviate
plant stress?

University of Illinois SDI System

- Five acres of corn and five acres of soybean with 24 equally sized zones per crop

- Zones regulated for differential application of irrigation and fertigation

- Completed May, 2014



Innovative Subsurface Drip System

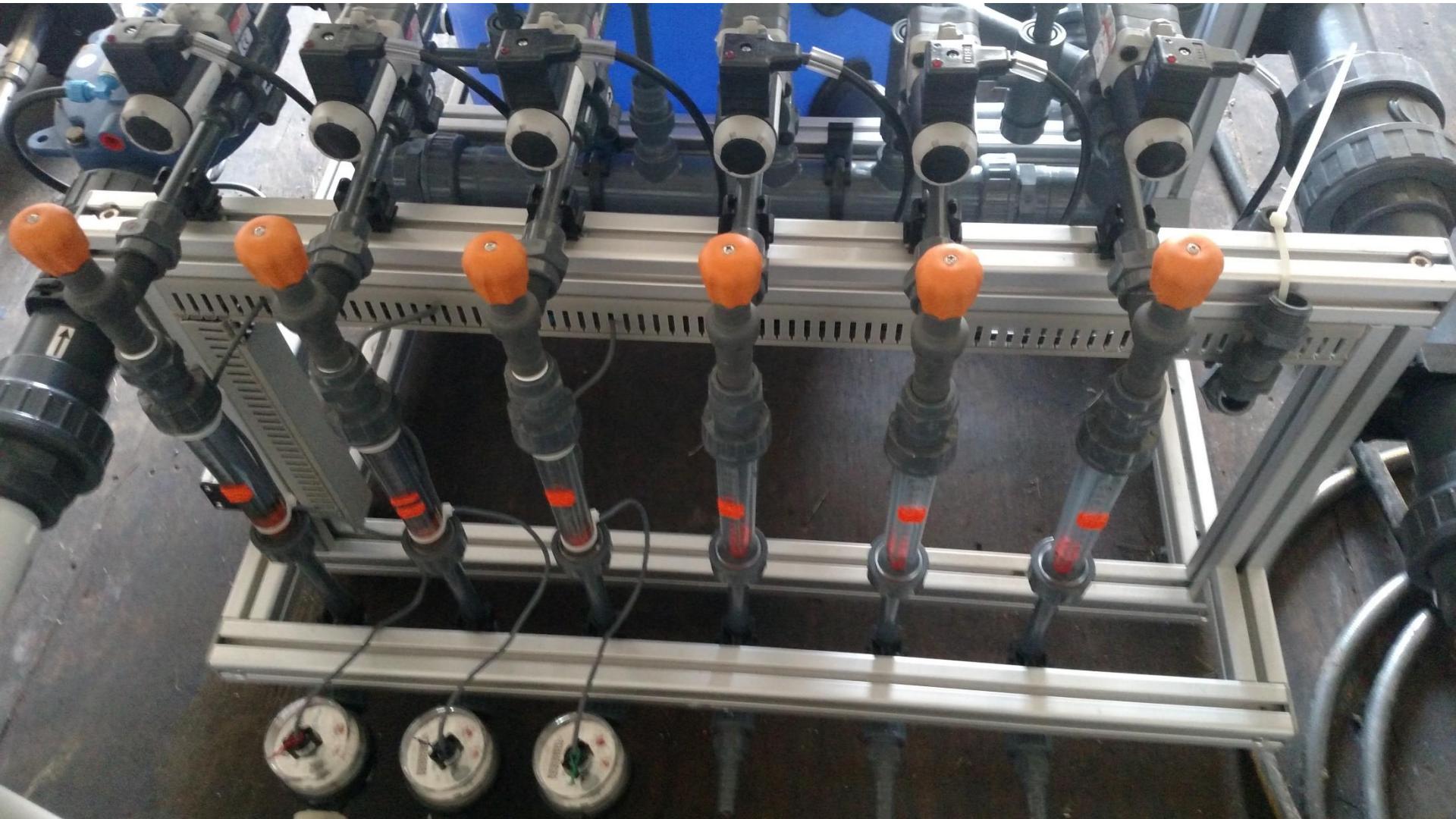
- Dripperline spaced every 30" buried ~14-16" below ground
- 24 different zones for each crop allows for precise application of nutrients according to plant needs



Innovative Subsurface Drip System



Innovative Subsurface Drip System



Hypothesis for Better Nutrient Use with Subsurface Drip Irrigation

- Even when water from irrigation is not needed, we can increase corn yields by 30 bushels by better timing nutrient availability with plant needs

Visual Fertigation Response- 2014



Control
180 lbs N

Fertigated
180 lbs N + (80 - 0 - 70 - 14S)

All treatments balanced for water. Champaign, IL

Visual Fertigation Response- 2015

Control
180 lbs N



Fertigated
180 lbs N +
(113 -120 -150 -12S)

All treatments balanced for water. Champaign, IL

Fertigation Improved Yield Over Base Fertility

Treatment	2014	2015
bushels/acre		
Irrigated	175	194
Fertigated	195	246
Δ	20	52

- Irrigation = 180 lbs N (adequate soil test values)
- Fertigated 2014 = 180 lbs N plus 80-0-70-14S
- Fertigated 2015 = 180 lbs N plus 113-120-150-12S
- Average of 5 hybrids and 4 plant densities

Can We Improve Corn Yield By Better Timing of Nutrient Availability?

- Same level of nutrients applied
 $180 \text{ N} - 100 \text{ P}_2\text{O}_5 - 100 \text{ K}_2\text{O}$
- Apply all to soil at planting with no supplemental water
- Apply half at planting and the other half via subsurface fertigation (with 17" water)



Fertigation Nutrient Application Schedule - 2016

Growth Stage	Application Amount (lbs/acre)		
	N	P ₂ O ₅	K ₂ O
V5&6	45	0	0
V7&8	9	0	10
V11&12	9	10	15
V13&14	9	10	10
VT&R1	5	0	10
R2&R3	5	10	5
R4&R5	8	20	0
Total	90	50	50

In addition to 90-50-50 lbs at planting

Critical Need for a Upfront Fertility

Hybrid	100% Preplant	50% Preplant + 50% Fert.	Δ
bushels/acre			
7087VT2P	258	197	-61*
8621VT2PRIB	244	200	-44*
DKC61-54	232	191	-41*
DKC64-87	248	205	-43*
N74R-3000GT	253	180	-73*
Average	247	195	-52*

Average of four plant densities

All treatments received (180-100-100) Champaign, IL 2016.

Upfront versus Split Application of N in 2016

- Champaign, IL, 4th year corn with total of 160 lbs N/acre
- Harrisburg, IL , corn/soybean rotation with total of 140 lbs N/acre
- For both sites: Upfront N as surface applied urea; Split as half urea upfront and half at V8 as UAN surface applied as either broadcast or using Y-drop
- Measure grain yield and total (above ground) plant N accumulation at physiological maturity (R6)

Research Y-Drop Applicator Courtesy of Yield 360



Upfront versus Split Application of N in 2016

Treatment	Grain Yield	Plant N Accumulation
	bushels acre ⁻¹	lbs N acre ⁻¹
No Applied N	63	54
All N Upfront	203	156
50/50 Split Broadcast	182	122
50/50 Split Y-Drop	190	131
LSD (0.10)	11	15

Champaign, IL 4th year corn with total N of 160 lbs N/acre
Upfront N as urea; Split as half urea upfront and half at V8
as UAN sprayed down the center of the row or as Y-drop

Upfront versus Split Application of N in 2016

Treatment	Grain Yield bushels acre ⁻¹	Plant N Accumulation lbs N acre ⁻¹
No Applied N	70	51
All N Upfront	160	110
50/50 Split Broadcast	144	98
50/50 Split Y-Drop	150	98
LSD (0.10)	8	9

Harrisburg, IL corn/soybean rotation with total N of 140 lbs N/acre, Upfront N as urea; Split as half urea upfront and half at V8 as UAN sprayed down the center of the row or as Y-drop

Conclusions

- Substantial yield increases are possible with fertigation using subsurface dip irrigation, but a certain level of up front fertility (nitrogen?) is needed for success
- Fertility sets the trajectory for rapid plant growth and high corn yields

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For more information:

Crop Physiology Laboratory at the
University of Illinois

<http://cropphysiology.cropsci.illinois.edu>