Potassium Nutrition On High K Testing Soils

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Council Bluffs, IA

http://gmoanswers.com/sites/default/files/corntatt.jpg/

My Background

5th Generation farm family in eastern Nebraska – 500 acres corn and soybeans

Affiliate Professor Colorado State University.
- Ph.D. Montana State University,
- Extension Soil Specialist UC Davis.

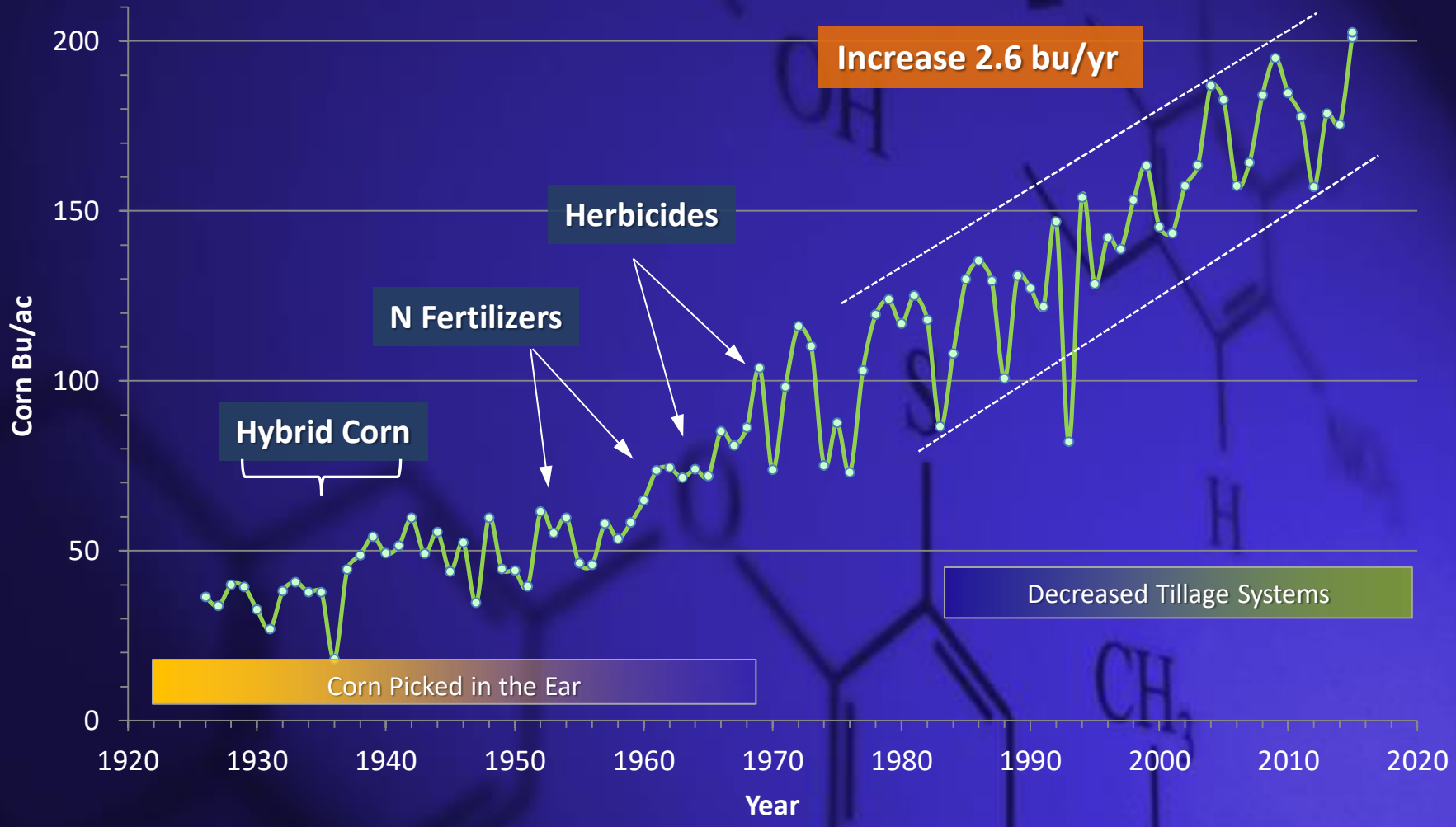
Conduct Regional Research in Soil Sampling, Soil Fertility, Lab Analysis and Coordinate the Agricultural Laboratory Proficiency (ALP) Program.

Photographed at the William Lefler farm in Sarpy County, Nebraska in the mid-1930s.

Millard Lefler, Craig Hubbard, Harry Lefler, William Lefler

95 Years of Corn Yield

Northwest IA Grain Yield



[1] Corn yield 3 yr weighted average, source: http://quickstats.nass.usda.gov/results, North west Iowa

Miller, 2016

Overview

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Soils and Tissue

Corn Growth and Development

Nutrient Accumulation, N and K

Midwest Potassium Corn Research

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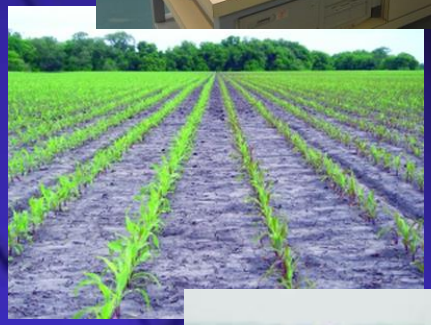
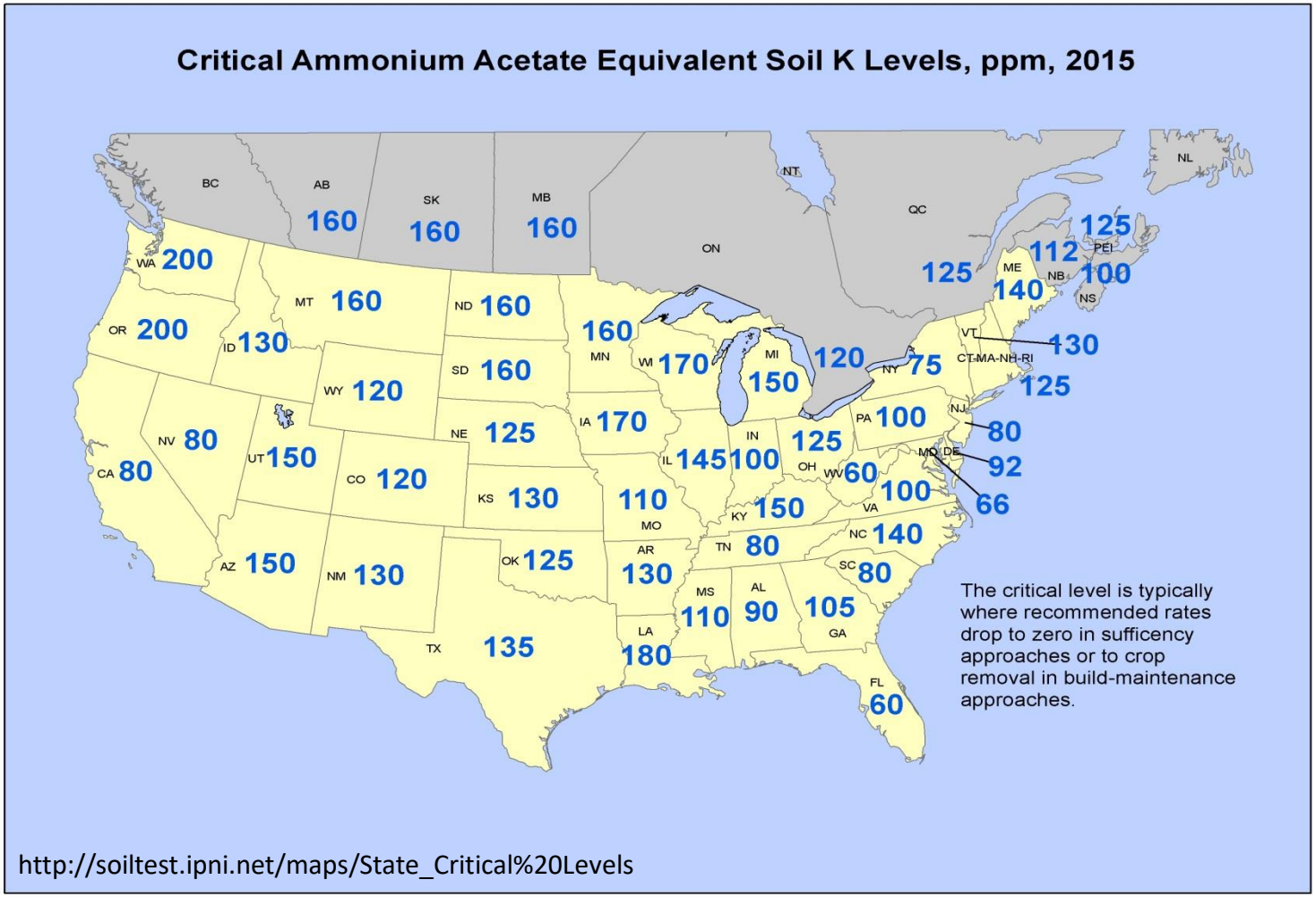


Miller, 2016

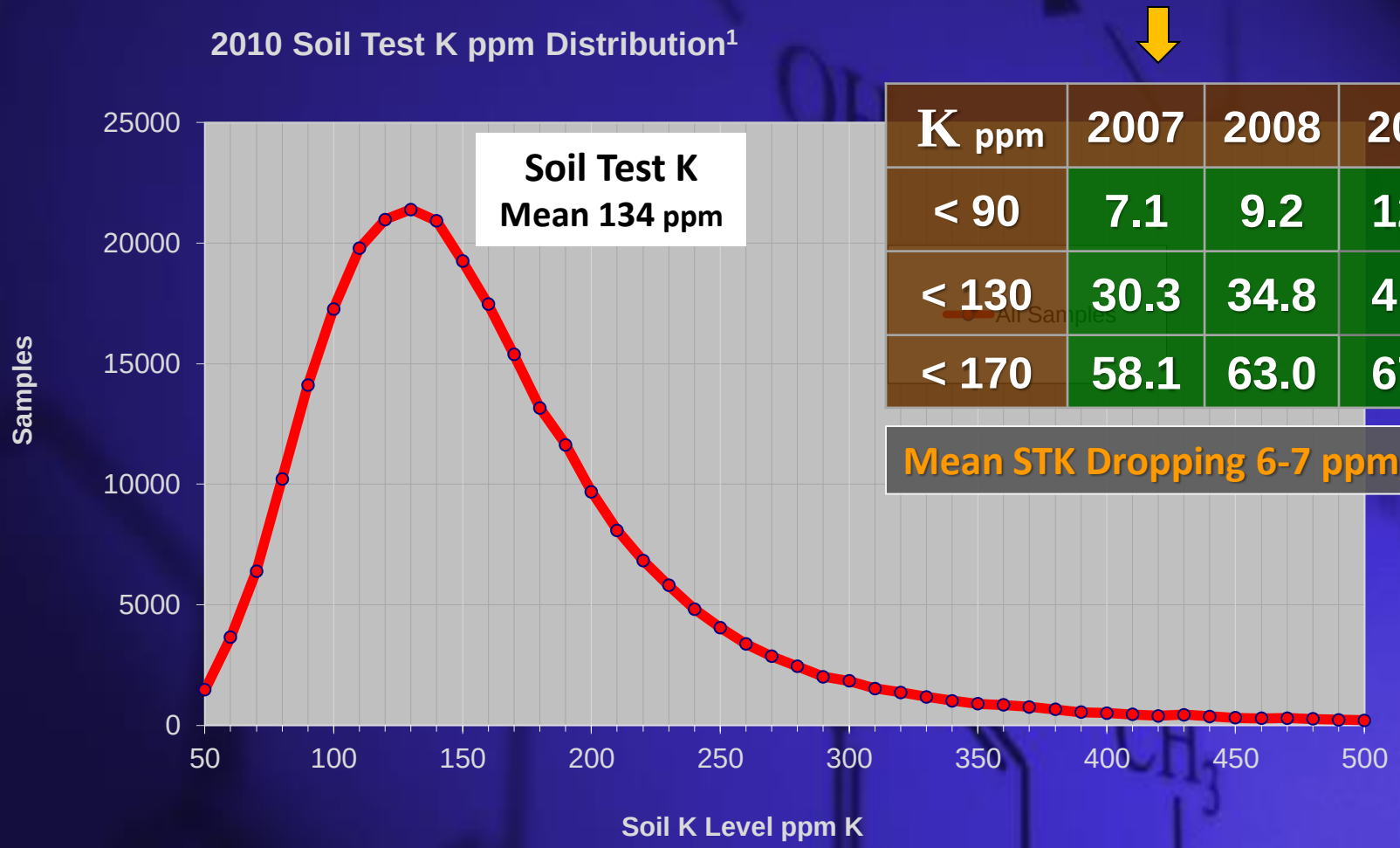
STK North America 2015



Source: IPNI, 2015 Better Crops with Plant Food

Lab Soil Test K - Iowa

Observations



K ppm	2007	2008	2009
< 90	7.1	9.2	12.9
< 130	30.3	34.8	41.6
< 170	58.1	63.0	67.8

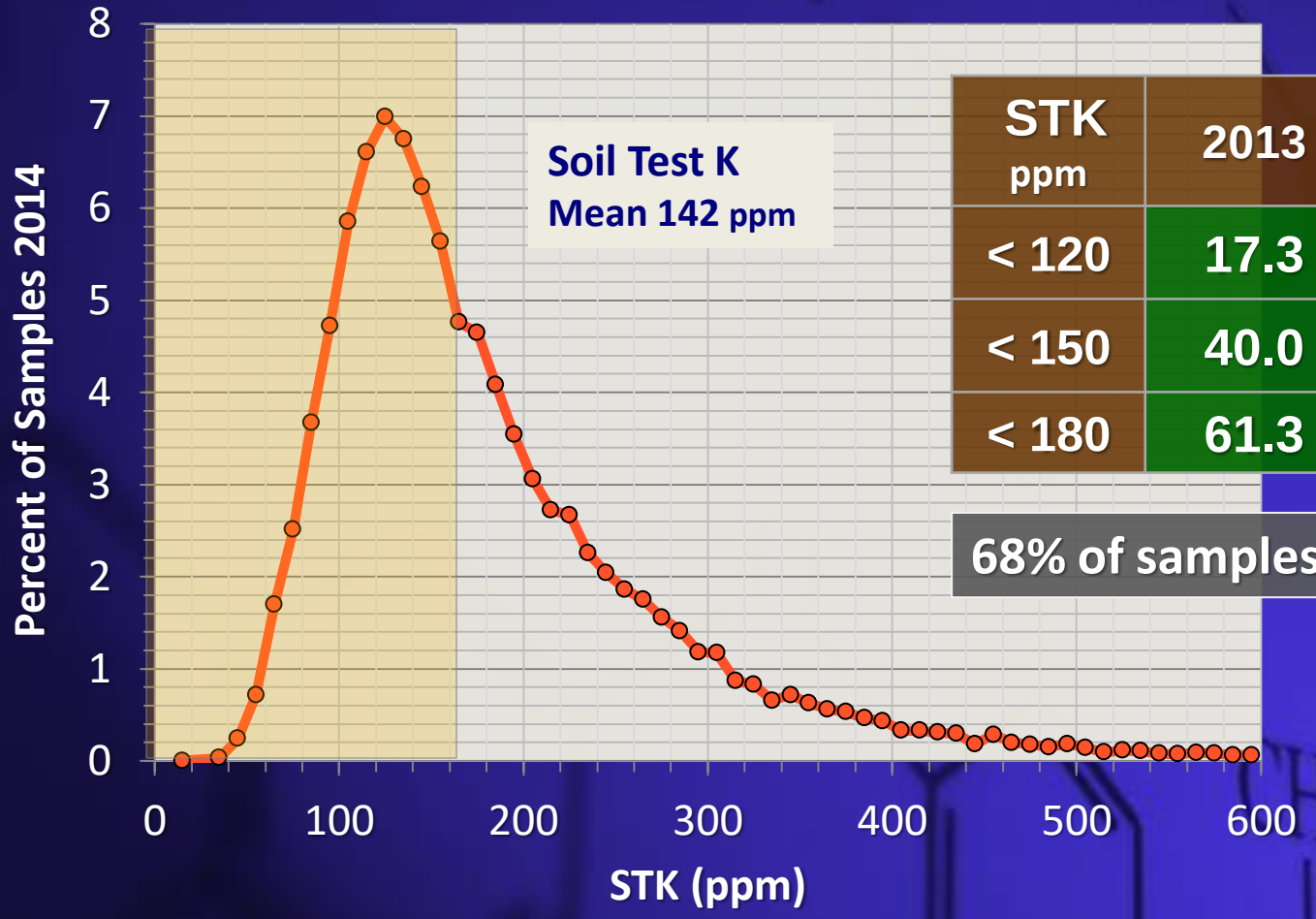
Mean STK Dropping 6-7 ppm/yr

[1] Source: **LGI Laboratories**, 2010.

Miller, 2016

Soil Test K: Minnesota

Observations 245,000 samples



STK ppm	2013	2014	2015
< 120	17.3	16.4	24.8
< 150	40.0	43.1	47.3
< 180	61.3	63.6	69.4

68% of samples have K Rec

[1] Source: MVTL, Mehlich 3 K

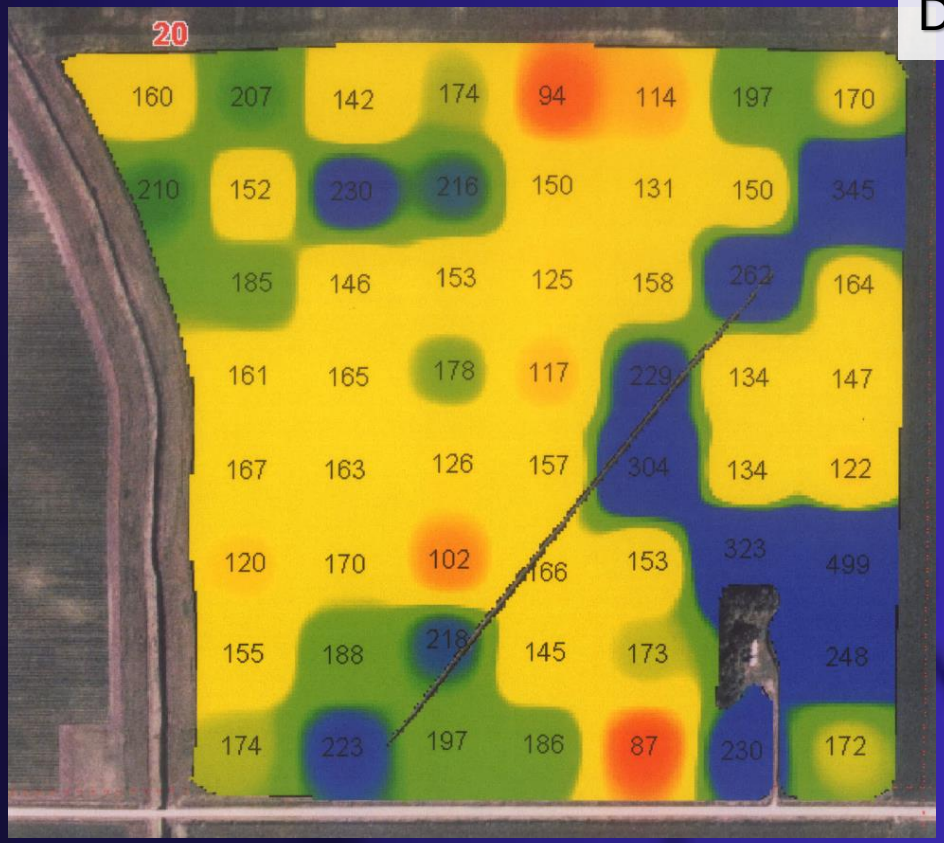
Miller et al, 2016

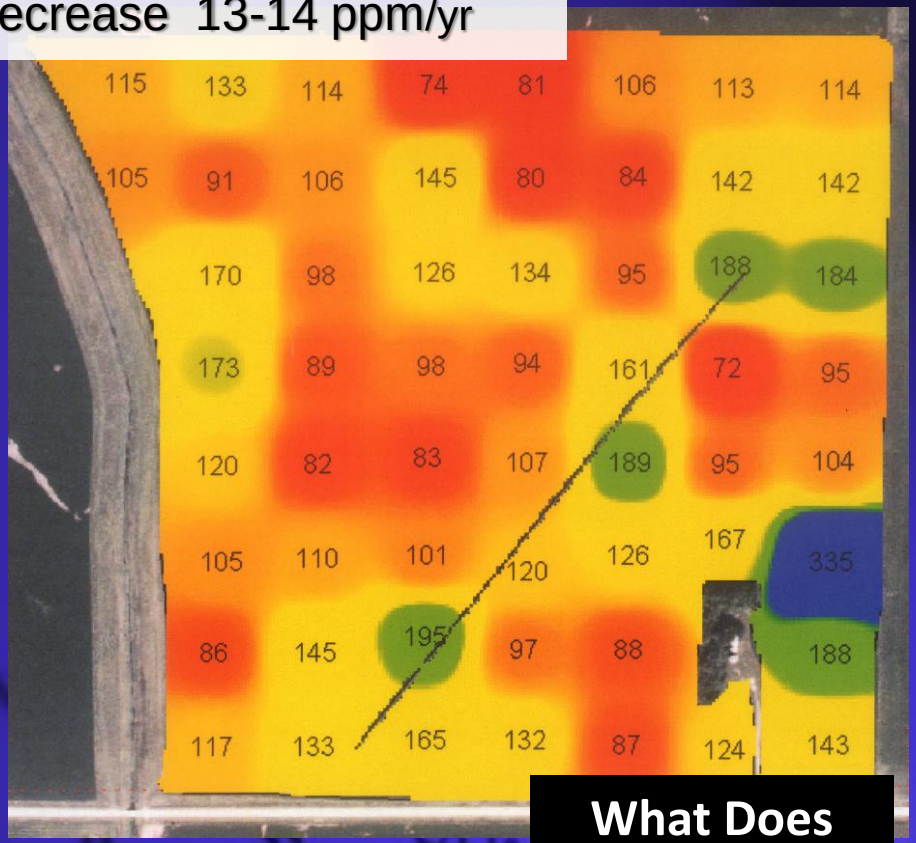
STK Changes in a Field

Location: North Central Iowa[1]

Average STK drop: 55 ppm

Decrease 13-14 ppm/yr





What Does Plant Analysis Show

4 Yr fertilizer applied: 220 lbs/ac

[1] Source, Midwest Independent Samplers, 58 grid points.

Miller, 2016

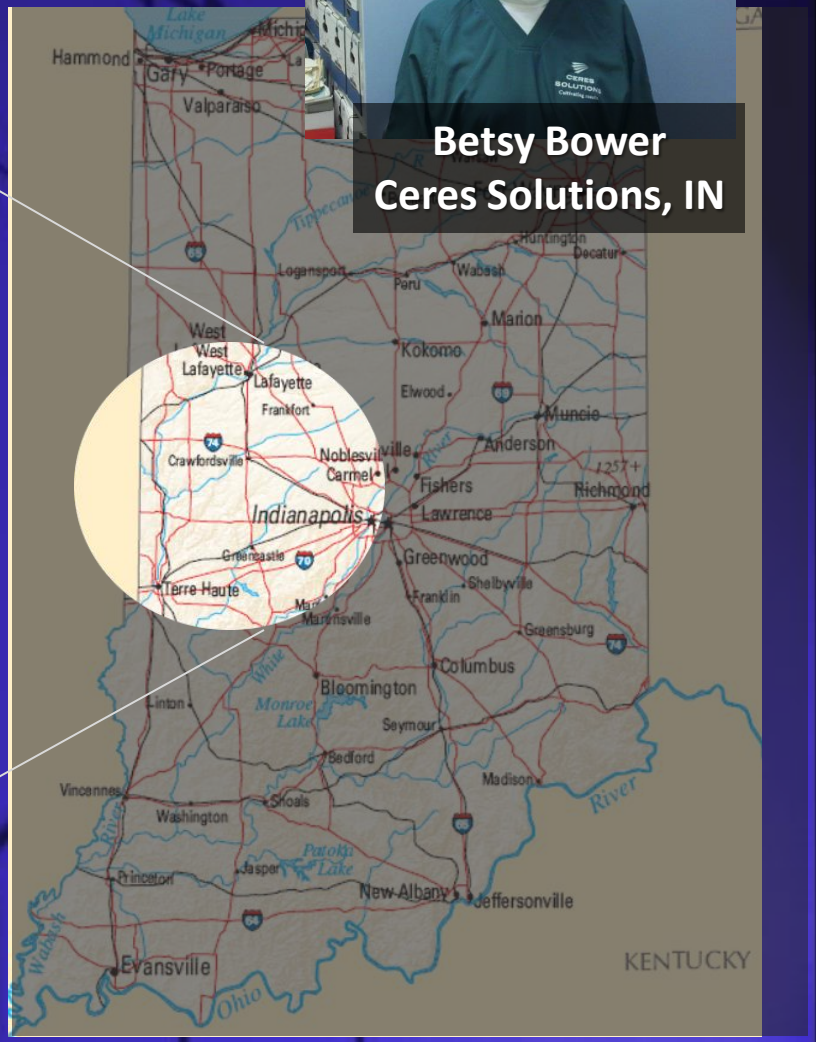
Ceres Solutions Corn Leaf Sampling

In 2010 Ceres Solutions serving growers in Western Indiana began intensive sampling of maize ear leaves GS VT-R1 for nutrient status.

Sampling: Area < 0.50 ac, 40 plants. Fields ranged in: soil type, hybrid, population, fertility and crop management systems. Analysis included N, P, K, Mg, Ca, S, Zn, Mn, Fe, Cu, B, and Mo.

Project has continued through 2016.

Betsy Bower
Ceres Solutions, IN



Corn Ear Leaf Nutrients - IN

Ear Leaf VT-R1 2518 samples, 6 years

Nutrient	Deficiency Threshold [1]	Percent of Samples Deficient [2]					
	< Less Than	*2010*	*2011*	*2012*	*2103*	*2014*	*2015*
N (%)	< 2.76	5.1	5.0	33.1	10.5	16.6	44.7
P (%)	< 0.25	0.6	1.1	20.4	2.7	1.1	13.2
K (%)	< 1.75	29.4	15.3	57.3	17.9	21.4	6.9
S (%)	< 0.16	1.1	0.2	8.1	2.4	7.4	23.2
Zn (ppm)	< 19	4.5	7.2	0.6	6.6	3.0	20.4

Long Term Average

N 18.2 %

K 24.7 %

[1] *Deficiencies based on: www.extension.purdue.edu/extmedia/nch/nch-46.html*

[2] *Data Ceres Solutions, Lafayette, IN, corn ear leaf VT-R1*

CERES SOLUTIONS
Cultivating results.

Miller and Bower, 2016

Corn Ear Leaf Nutrients - IN

Ear Leaf VT-R1 2014, 281 samples

Nutrient	Percent of Samples Nutrient Deficient					
	P	*K*	*Mg*	*S*	*B*	*Zn*
Threshold [1]	< 0.28	< 1.76	< 0.16	< 0.16	< 5	< 20
Low N Sites < 3.00 (%)	5.7	11.4	20.1	16.1	23.8	9.5
High N Sites > 3.20 (%)	0.7	22.5	18.3	1.2	11.9	2.8

[1] *Deficiencies based on: www.extension.purdue.edu/extmedia/nch/nch-46.html*

[2] *Data Ceres Solutions, corn ear leaf VT-R2*

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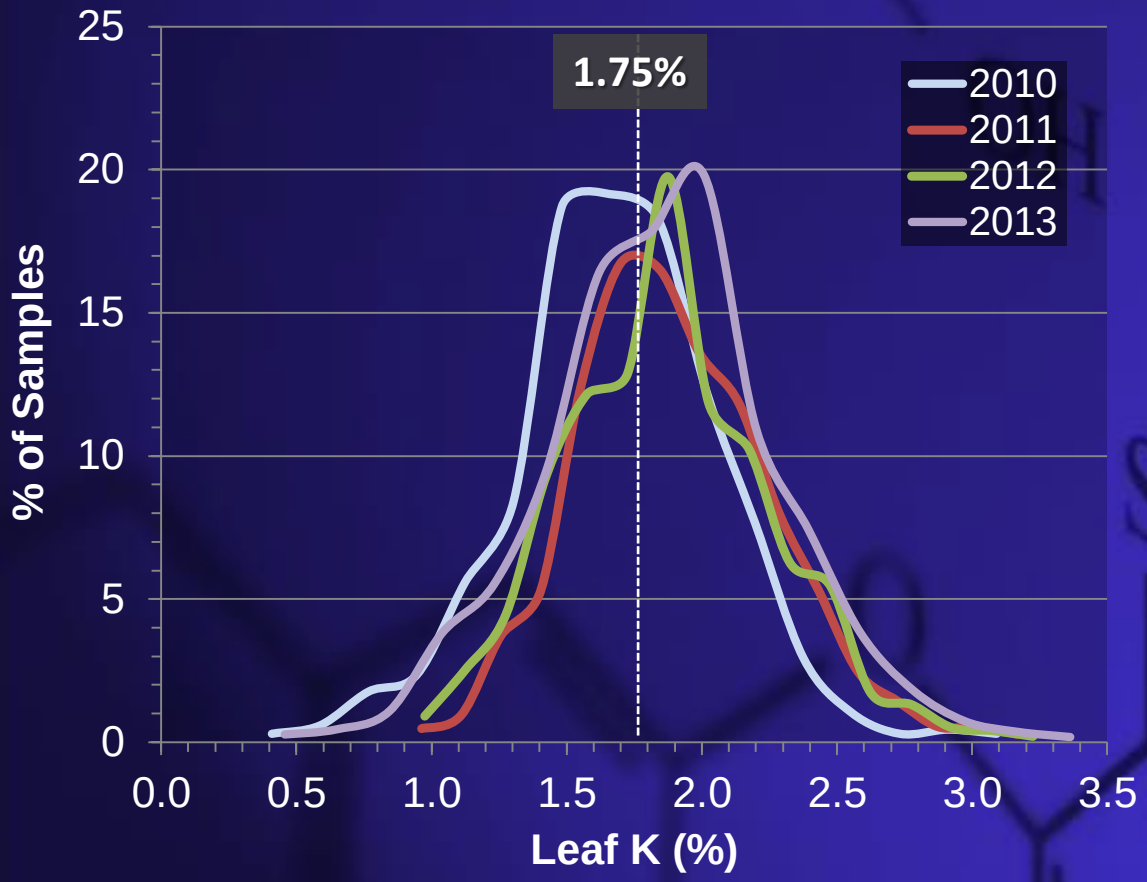
Cultivating results.

Miller and Bower, 2016

Corn Ear Leaf Potassium - MN

Ear Leaf VT-R1 4241 samples, 4 years [1]



Over four years K deficiency [2] in Minnesota constituted 42 – 56% of ear leaf tissue samples, whereas N deficiency average was 33% of samples.

[1] *Source Winfield Solutions 2010-2014, Randy Brown, Tim Eyerich*

[2] *http://www.extension.purdue.edu/extmedia/nch/nch-46.html*

WINFIELD™ SOLUTIONS

Miller et al, 2016

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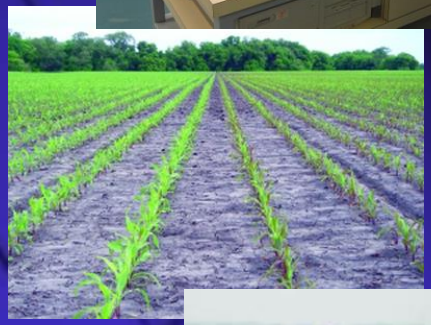
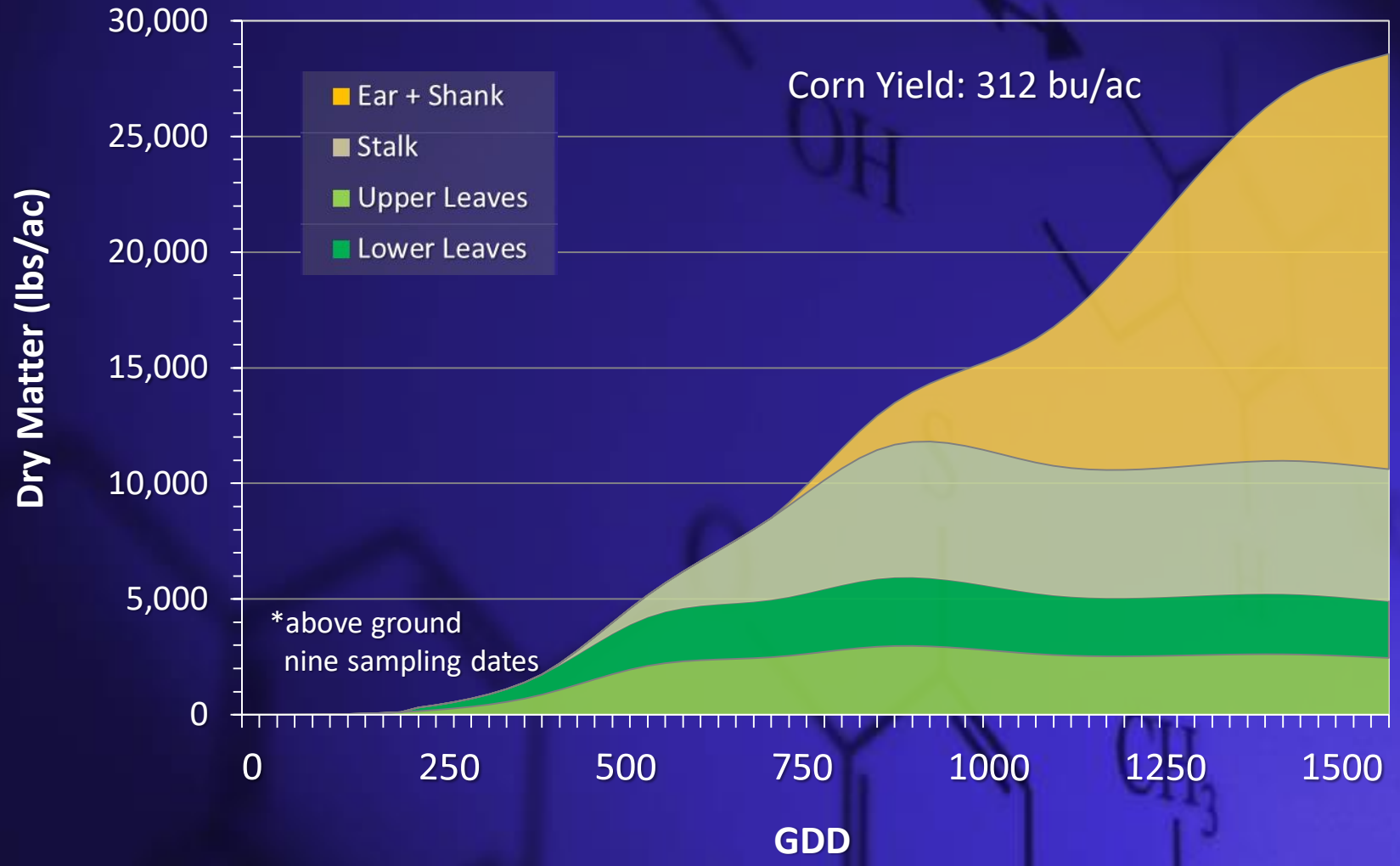


Miller, 2016

Corn Dry Matter Accumulation: Karlen et al 1988 [1]



[1] *Calculated from: Karlen, Flannery, and Sadler. 1988. Agron J. 80:232-242.*

Miller, 2016

Corn Nitrogen Accumulation [1]


mode/false?v=mpbl-1

Corn Yield: 312 bu/ac

Ear + Shank
Stalk
Upper Leaves
Lower Leaves

lbs/ac

350
300
250
200
150
100
50
0

*above ground

0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600

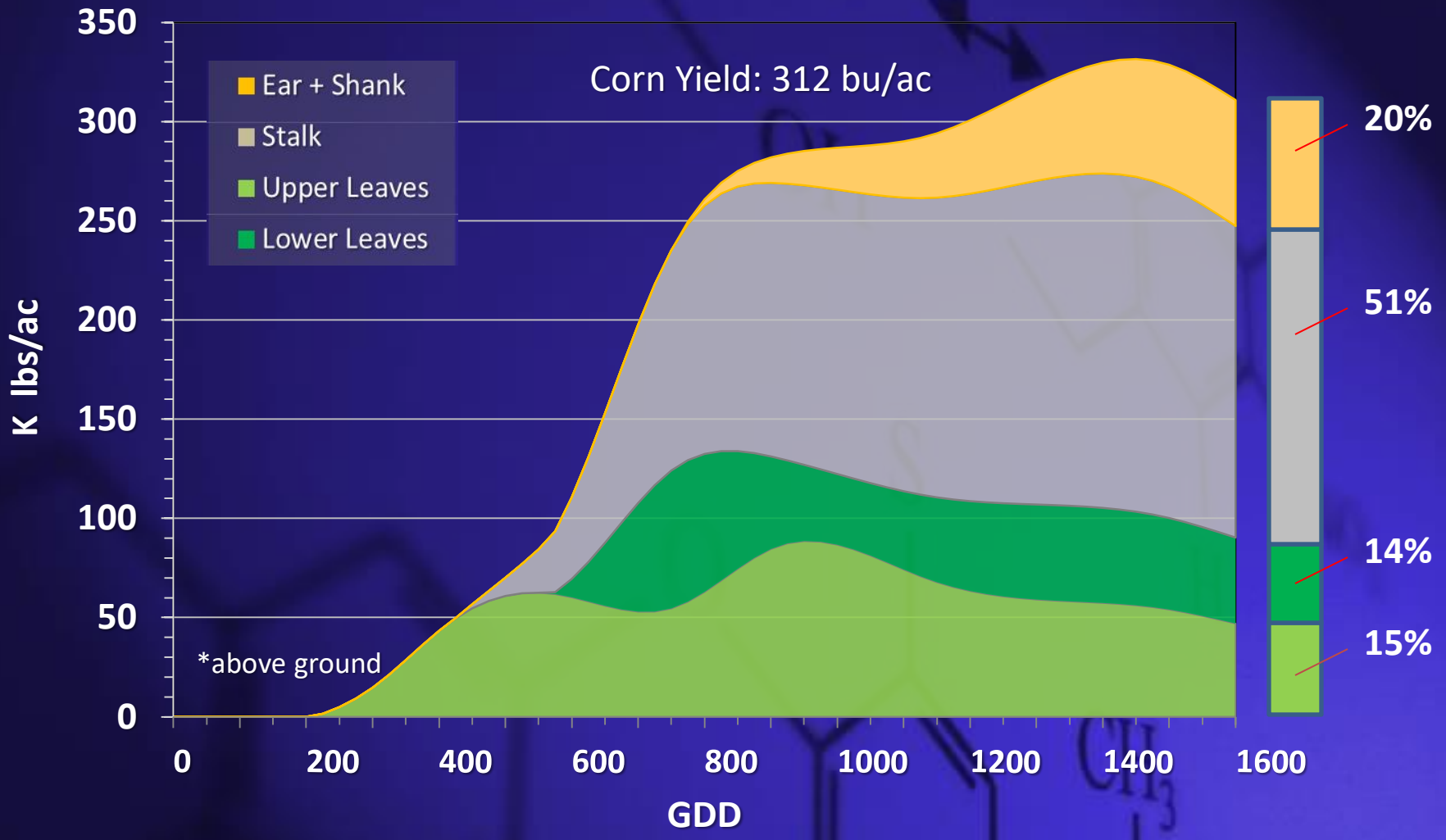
GDD

66%
9.7%
14%
12%

[1] *Calculated from: Karlen, Flannery, and Sadler. 1988. Agron J. 80:232-242.*

Miller, 2016

Potassium Accumulation: Karlen et. al. 1988 [1]



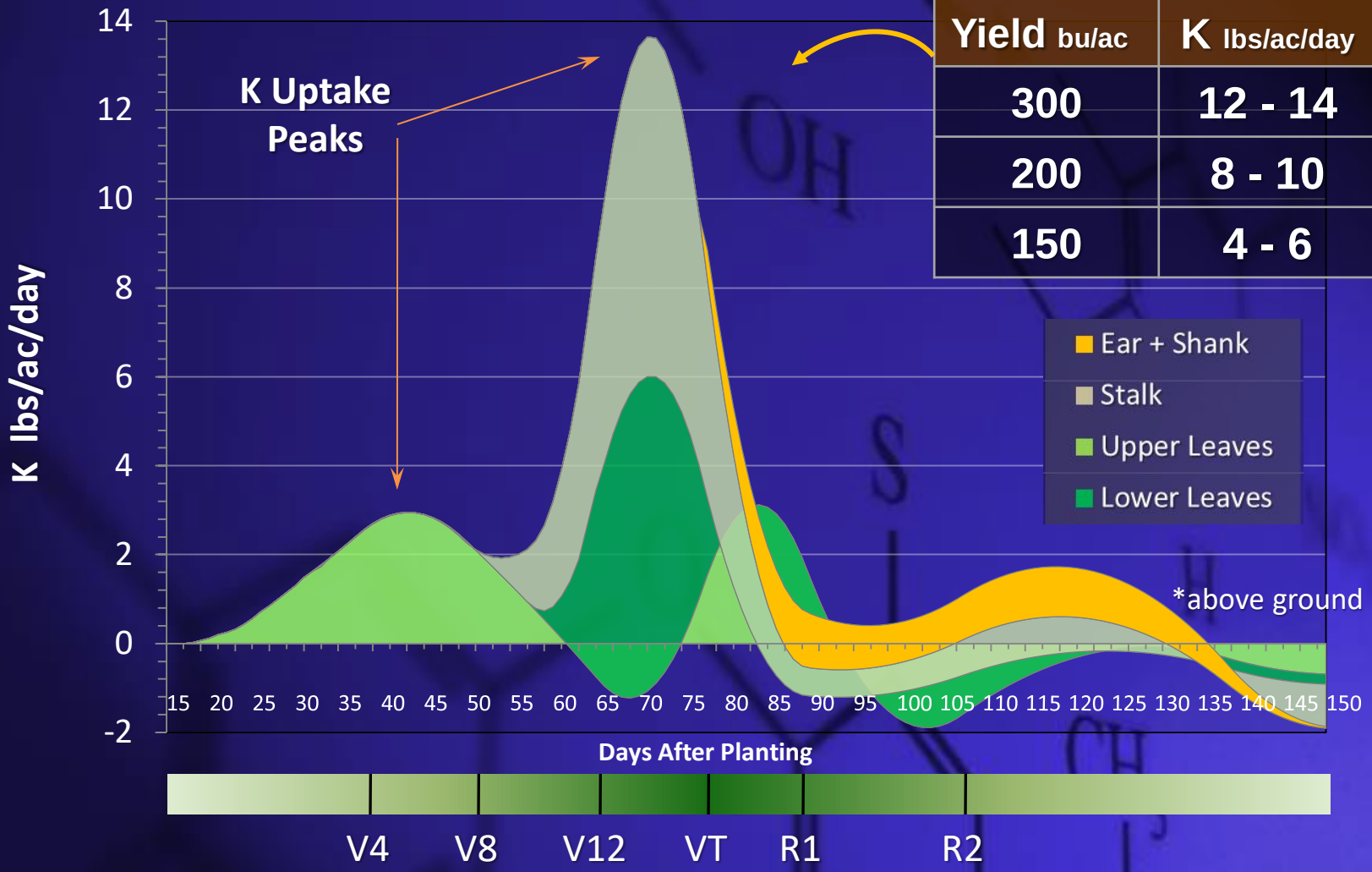
[1] *Calculated from: Karlen, Flannery, and Sadler. 1988. Agron J. 80:232-242.*

Miller, 2016

Corn Potassium Accumulation Rate [1]

www.udel.edu

Yield bu/ac	K lbs/ac/day
300	12 - 14
200	8 - 10
150	4 - 6



[1] *Calculated from: Karlen, Flannery, and Sadler. 1988. Agron J. 80:232-242.*

Miller, 2016

Corn: Population, Yield and K Uptake

Source / Year	Population	Yield	Total K uptake	K per unit yield [1]	Total K uptake per plant
	plants/ac	bu/ac	lbs/ac	lbs/bu	g /plant
Sayre, 1948	10,700	102	113	1.12	4.2
Jordan et al, 1950	12,000	78	82	0.96	2.9
Hanway, 1962	17,300	114	101	0.89	2.7
Rhoads and Stanley, 1981 [2]	24,000	202	223	1.10	4.2
Karlen et al, 1988	42,800	308	312	1.01	3.3
Doberman, 2001	30,000	234	273	1.17	4.1
Bender et al, 2013 [3]	34,100	230	149	0.65*	1.9*

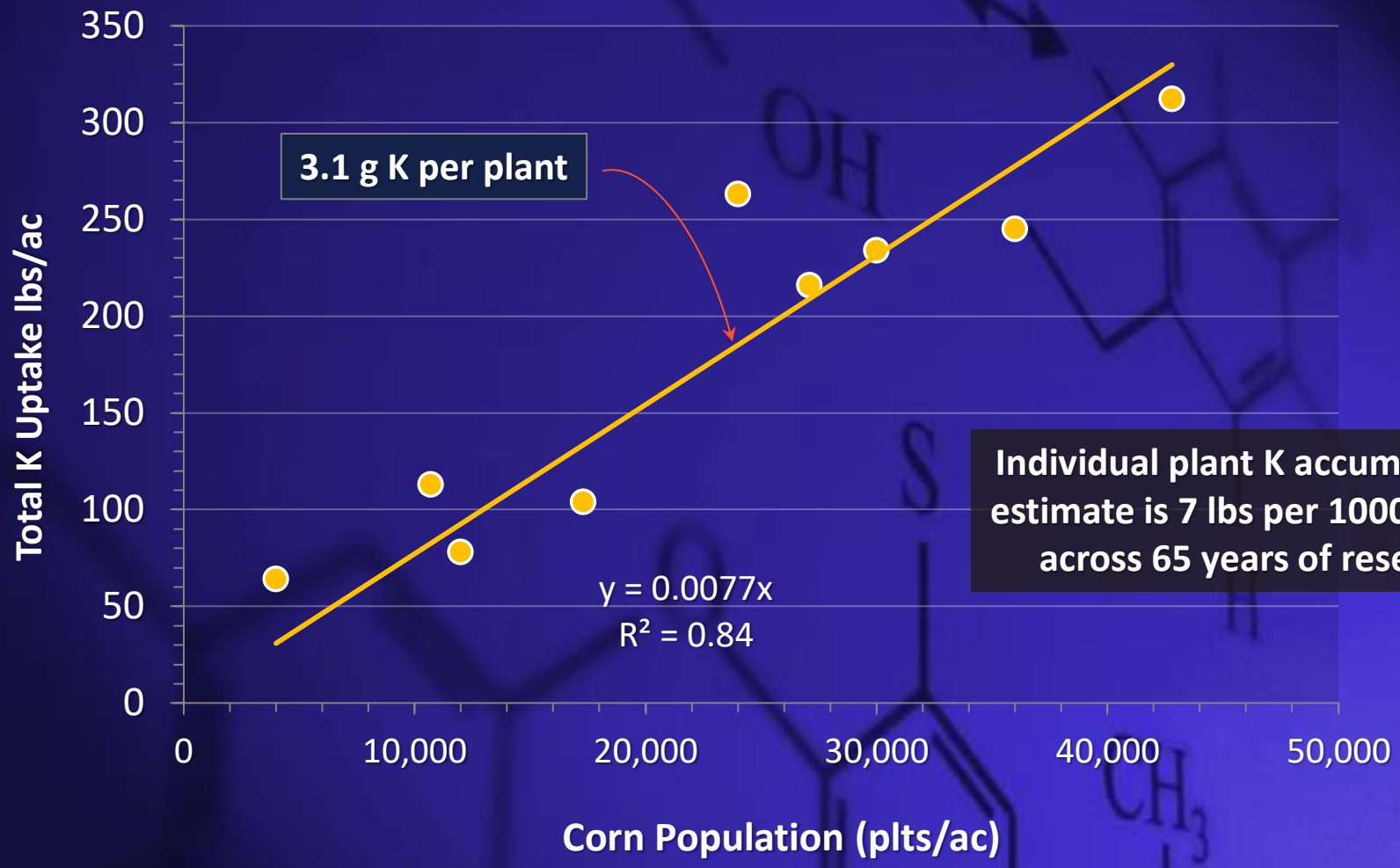
[1] *Cassman (2003),* Optimum K Accumulation 0.95 to 1.1 lbs of K per bushel of grain.

[2] *Comment, Plots received fertilizer applications prior to growth stage R1, total 140 lbs/ac.*

[3] *Note , soil test K was 153 ppm, there was no reported use of K fertilizer.*

Miller, 2016

Corn Population vs K Uptake [1]



Individual plant K accumulation estimate is 7 lbs per 1000 plts/ac across 65 years of research

[1] *Source of data: Sayre, 1948; Jordan et al 1950; Hanway, 1962; Rhoades and Stanley 1981; Karlen et al 1987; Karlen et al 1988; and Doberman, 2003.*

Miller, 2016

Corn Yield: Max K Uptake Rate

Yield [1] Environment	Population	Yield	Total K Uptake	Total K uptake per plant	Max K Uptake Rate
	plants/ac	bu/ac	lbs/ac	g/plant	lbs/ac/day
Low	**27,100**	**204**	**216**	**3.6**	**13.3**
High	**36,000**	**225**	**245**	**3.1**	**20.9**

[1] Results from 1980, Florence, SC, site had Mehlich 1 K of 47 mg/kg and received 150 lbs/ac K over multiple applications.
Source: Karlen, Sadler and Camp,. 1987. Agron J. 79:649-656.

Max K uptake rate is proportional to higher populations (i.e. potential yields) have higher K requirements

Miller, 2016

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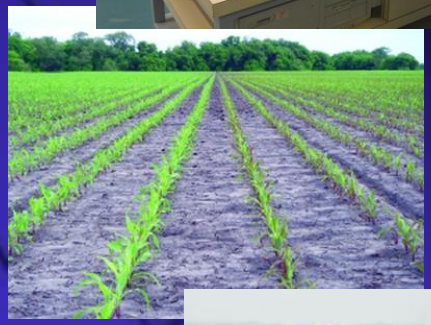
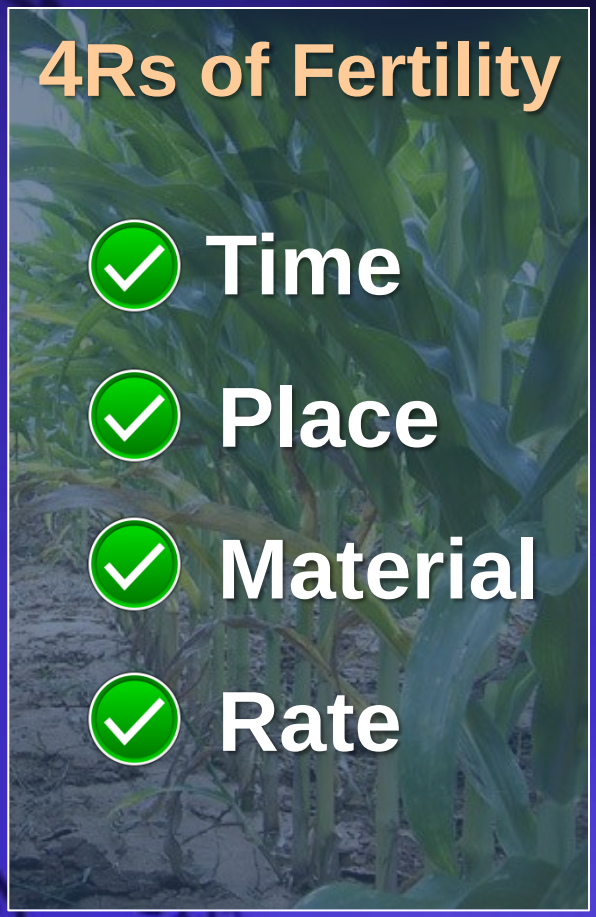


Miller, 2016

K_{RX} Corn Research

2011-2016, 78 studies were conducted across six states to evaluate K applied at 0, 50, 100 lbs/ac at growth stage V3 – V5,using spoke wheel injector, eight replications. Population: 18,600 – 42,400 plts/ac.

STK sampled at planting, corn ear leaves at VT, and grain yield and moisture determined based on 3/1000th acre of each plot at black layer.



Robert Nielsen, 2009

http://a1.sphotos.ak.fbcdn.net/hphotos-ak-snc6/58602_151587434865720_111267718897692_355055_4317263_n.jpg

Miller et al, 2016

KR_X Corn Yield Response

Yield Results 2011, six IA and NE sites

Site	STK	Check	+K	Increase
Cty / State	ppm	bu/ac		
Cherokee, IA	268	220	231	+11*
Calhoun, IA	296	194	207	+13*
Webster, IA	185	185	186	+1
Webster, IA	153	207	215	+8*
O'Brien, IA	238	212	208	-4
Hamilton, NE	423	231	232	+1

* Yield significant at the 0.10 level, corn 15.5% moisture.

K effect on ear size

K increased yield on soils STK > 250 ppm

Miller, 2013

KR_x Corn Yield Response

K*rx* Project Yield Results 2012

Six Iowa sites

Site	STK	Check	+K	Increase
Cty / State	ppm	bu/ac		
Pocahontas, IA	163	172	165	- 7
Palo Alto, IA	196	152	185	+ 33*
Calhoun, IA	126	166	171	+ 5
Wright, IA	135	154	175	+ 21*
Cherokee, IA	290	211	220	+ 9 *
Hardin, IA	147	204	216	+ 12*

* Yield significant at the 0.10 level, corn 15.5% moisture. STK 0-6" Depth

K effect on ear size

K increased yield on soils STK + 200 ppm

Corn Yield vs STK by Depth

2013 Yield 5 sites vs soil test K by depth, IA sites

Treatment/ Site	NEL 18	NIE 9	LAR 20	FRI 15	CAL 23
0 K bu/ac	149	155	192	205	226
+ 50 K[1] bu/ac	150	176	207	216	230
Delta Yield	+1.3	+21.4	+14.2	+11.6	+4.4

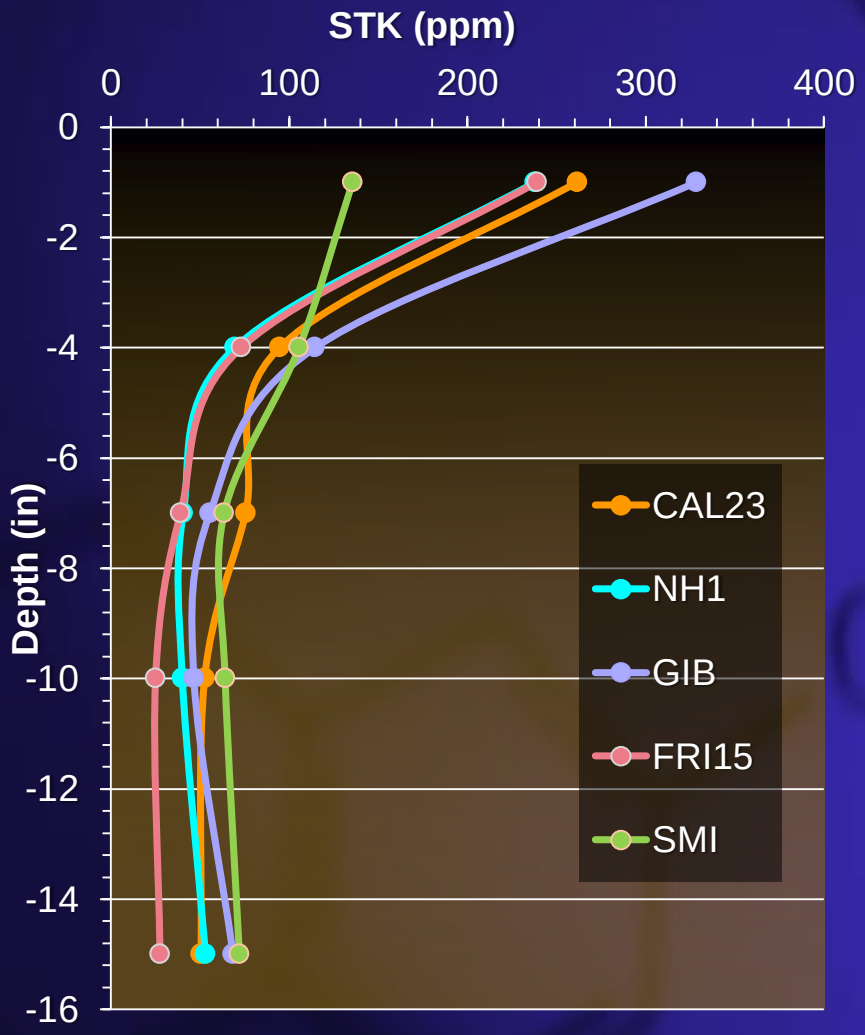
Depth (in)	STK (ppm)				
0 – 2	186	160	170	269	450
2 – 6	130	123	146	161	208
6 – 8	98	96	107	102	136
8 – 12	102	102	108	82	124

[1] Yield increase to application of 50 lbs/ac K at V4-V6.

* Yield responsive sites

Miller, 2016

STK Stratification – Five Sites 2014[1]



STK shows consistent elevated surface levels (> 3x subsoil) across 15 of 16 sites in 2014, 78% of all sites over four years.

Specific sites (i.e. GIB) the 0-2” depth is 5X the content of the 6-8” depth. All sub soils had STK < 90 ppm.

[1] 2014 KRx sites: Iowa and Illinois.

Miller, 2016

KR_X 2015 Corn Yield Response

Grain Yield Response to N and K (two sources)

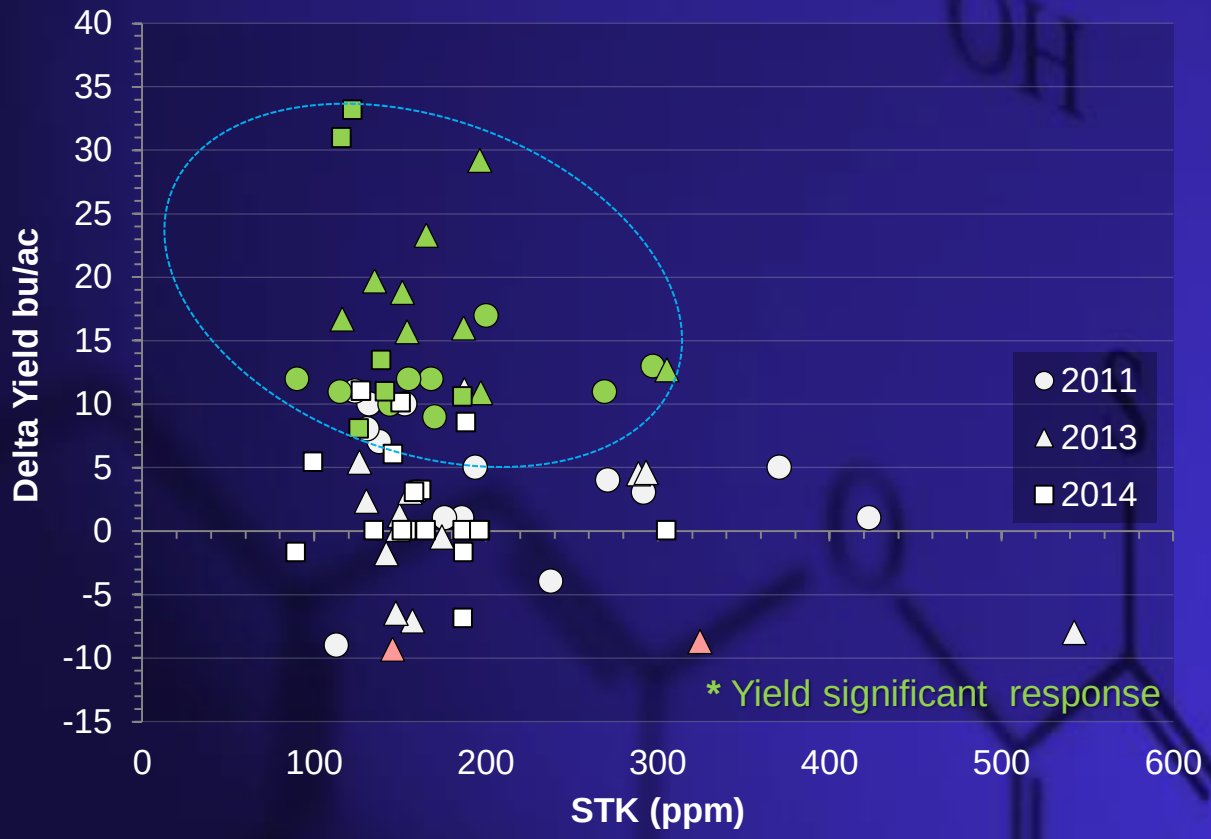
Treatment (lbs/ac)	*Iowa* *Sutherland*	*Wisconsin* *Dodgeville*	*Illinois* *Farmer City*
STK (ppm)	192	178	154
Check	194.1	219.0	183.2
50 K_{ac}	205.9	230.6 *	187.4
50 N	217.1 *	229.6 *	200.2 *
50 N + 50 K_{ac}	212.1 *	239.2 *	195.4 *
50 N + 50 K_{KCl}	204.1	240.5 *	203.8 *

[1] *Significant at p 0.1 level, 8 reps*

Miller et al, 2016

KR_X Corn Yield vs STK 3 years

An application[1] of 50 lbs K /ac improved grain yield at twenty-three locations.



Probability of yield response

STK 75 to 150	-	53%
STK 150 to 180	-	42%
STK 180 to 300	-	26%
STK 300 to 600	-	20%

Ave yield increase
11 bu/ac

[1] Yield increase to application of 50 lbs/ac K at V4-V6.

Miller, 2016

Soil Test K Contrast

KRx 2013 contrasting sites. D7 site with 107 ppm STK whereas the FMC site 170 ppm.

With near identical populations, Leaf N and K, the D7 site showed no yield response, where as FMC site had 14.5 bu/ac response.

STK not a consistent predictor of response. Note differences in Mg!

Parameter	units	O'Neil, NE D7	Victoria, IL FMC
Population	plts/ac	31,200	31,300
Yield	bu/ac	221	251
STK	ppm	107	170
Yield Response	bu/ac	-2.2	+14.5
Leaf N	%	2.98	3.01
Leaf K	%	1.88	1.76
Leaf Mg	%	0.18	0.42

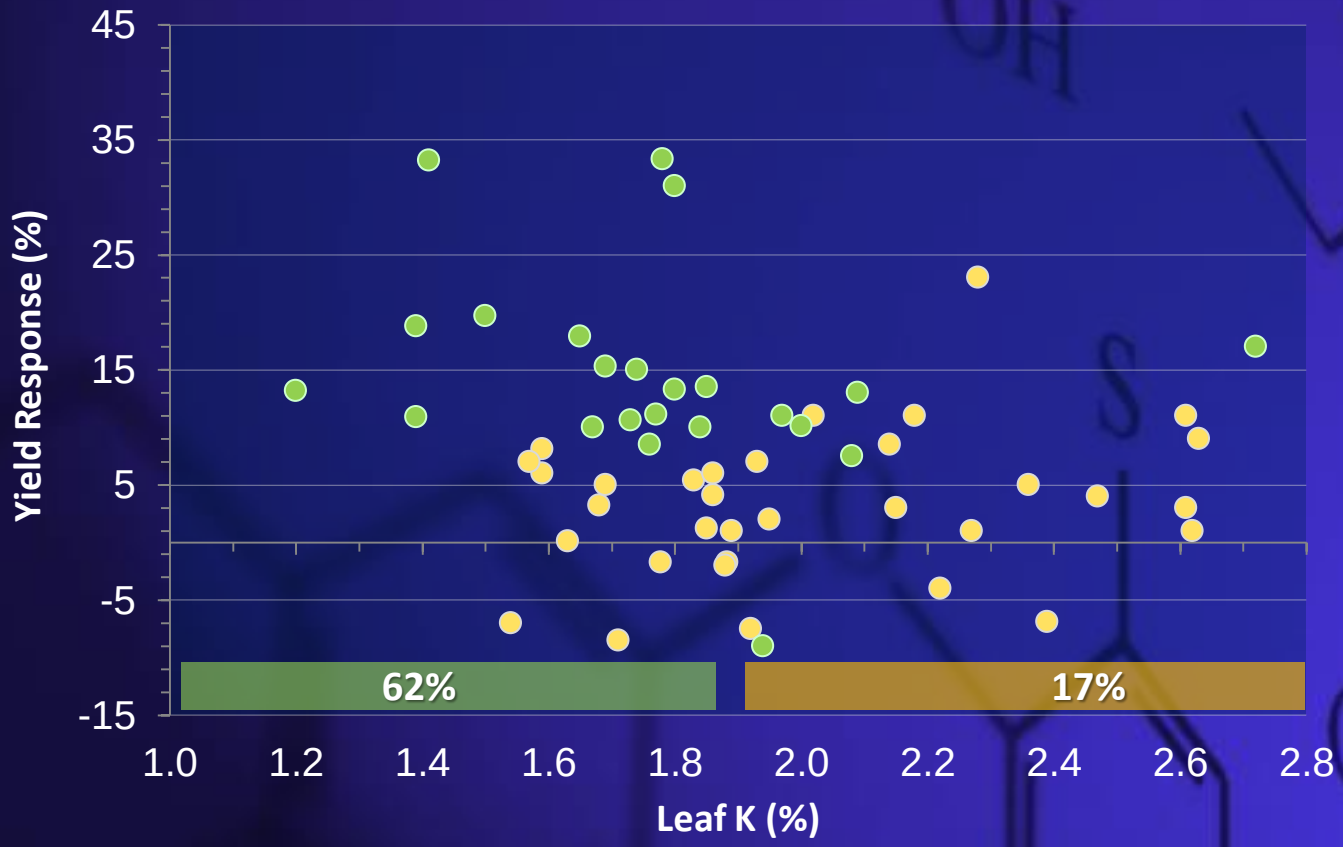
[1] 2013 Grain yield response to 100 lbs K/ac, applied V3-V4

Miller, 2016

KR_X Ear Leaf K vs Yield

A relationship between corn ear leaf K at VT and yield response to applied K, 56 sites 2011-2014.

www.hear.org/starr/images/image/?q=080914-9918&o=plants



- **Significant yield response to applied K**

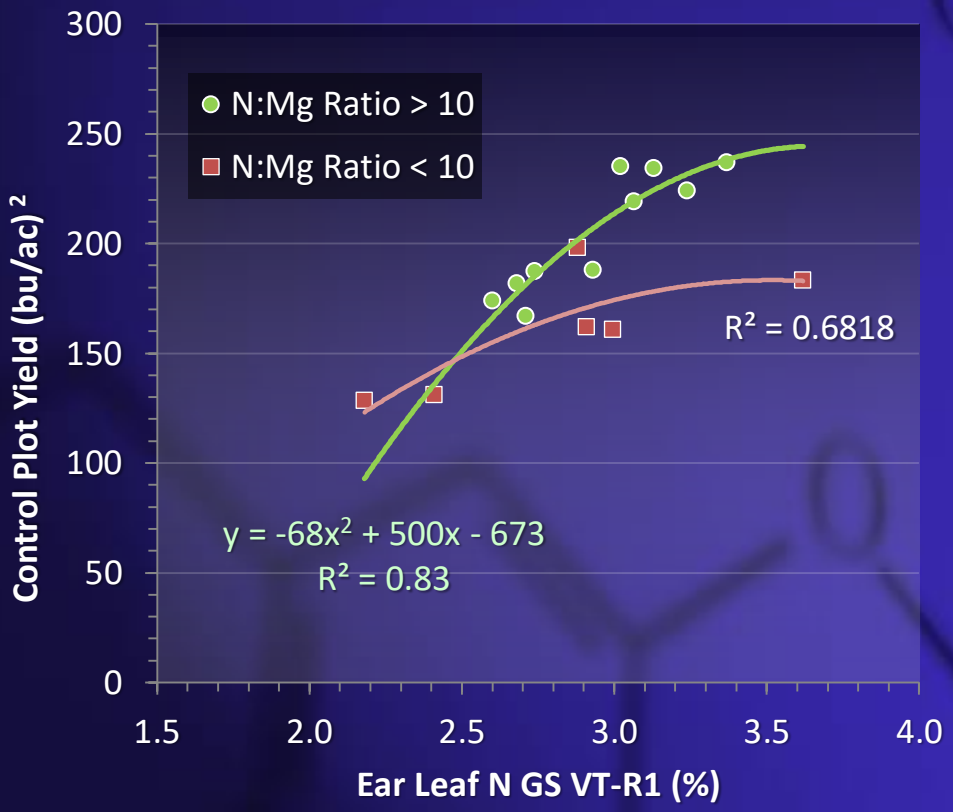
Leaf K < 1.90%, 64 % responsive to K application

Miller, 2016

KRx Prescription Potassium

Leaf Nutrition vs Grain Yield 2014

Parsing maize grain yield[1] by ear leaf ratios, shows 83% of yield is explained by leaf N, N:Mg > 10 (green) at ten sites. Six sites with N:Mg < 10 (red), averaged 44 bu/ac lower yields.



Analysis	N:Mg Ratio [3]	
	< 10	*> 10*
N %	2.90	2.95
K %	1.65	2.02
Mg	0.35	0.23
Mg:K	0.22	0.12
N:Mg	8.1	13.3
Yield bu/ac	204	159

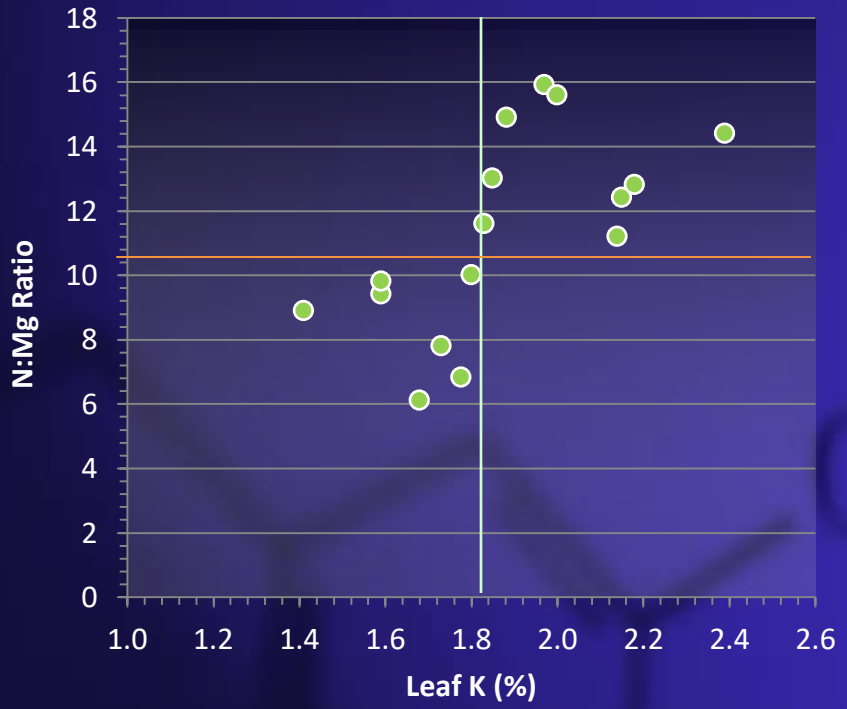
[3] Mean results based on N:Mg Ratio.

[1] 2014 KRx control plot grain yields 16 sites, 8 replications, 4 states.
[2] Sites vary in hybrids, tillage, soil types and crop history.

Miller et al, 2016

Yield and Leaf K and N:Mg Ratio

Cate Nelson analysis[2] of 16 KRx sites 2014 shows two primary clusters, sites < 1.85% K and N:Mg < 10 and sites with K > 1.85 %, N:Mg >10.



N:Mg Ratio Yield Differences

Year	*bu/ac* [2]
2011	58
2012	66
2013	52
2014	42

Relationship consistent across years.

[1] Data: Corn Ear Leaf VT K and N:Mg ratio, 2014.

[2] Corn yield data bases on control plot yield 8 replications.

Miller, Bower, & Smith, 2015

2016 Corn Ear Leaf Nutrients

26 K*Rx* sites, across six states.

Variable Average	Cluster [3]	
	Low Yield	*High Yield*
Yield (bu/ac)	194	254 *
N %	2.60	2.94
K %	1.75	2.37
Mg %	0.35	0.23 *
N:K	1.58	1.01
Mg:K	0.22	0.11
N:Mg	7.9	13.4 *

[3] Clusters based on 6 sites each, .

1 Each site represents the mean of 4 control plots.
2 Mg:K > 0.16 K deficient, Elwali ,1984 Agron J.

Analysis of 2016 VT-R1 ear leaves show the high yield cluster had 60 bu/ac advantage, with > K and < Mg levels.

N:Mg ratios were significantly higher for the high yield cluster, and trends indicated lower Mg:K and lower N:K.

N:Mg ratios >10 were indicative of highest yield for 5 years and agree published guidelines.

Miller et al, 2016

Summary

Additional yield data for 2017 is being compiled from IN, IL, IA and NE locations.

Midwest STK levels have and continue to decline, with decreased tillage K is increasingly stratified at the surface (0-2”).

Corn K uptake rate during vegetative growth, peaks during V8-V12 with rates 10-14 lbs/ac day for yields of 200 -250 bu/ac.

Results of K trials across the corn belt show K response of 8-32 bua/c on soils with 140 -290 ppm STK. However, tissue K was a better predictor of yield response than STK.

Sites with the highest ear leaf Mg:K and lowest N:Mg ratios show consistent lower grain yields, ranging from 42 - 60 bu/ac over six years.

Miller and Bower, 2016

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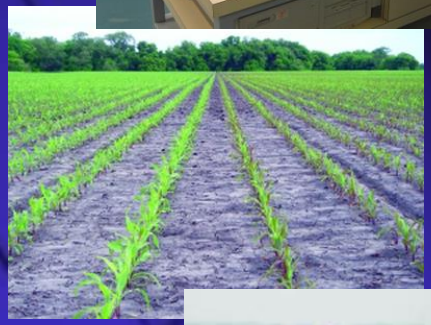


Miller, 2016

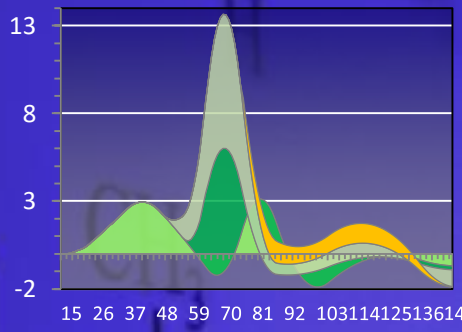
K Dynamics

STK is estimate of K supply, based on probability of response

Plant growth and therefore K uptake, is Demand driven

Drivers are population and N, growth stage specific – Soil depth 2-8”

When soil K diffusion/supply is limited V5-V12, result in Mg Uptake



Impact Yield

Miller, 2016

Recommendations

Management Tool	Recommendation	Optional
Potassium Soil Test	✓	
Sub Soil K Test		✓
Tissue Test	✓	

Assess sub soil K levels (2-6" or 2-8"). STK 100 - 120 indicate possible response. Assess at 10-20% of grid points.

Plant Analysis. Confirm fertility, ear leaf (VT-R1) K < 1.9%, Mg:K ratios > 0.16 and N:Mg ratios < 10 are indicative of K deficiencies. Track annually to assess K management.

Focus K fertilizer on subsoil applications – **side dress**. Surface broadcast applications do little. Don't expect STK or leaf K to change in 1 year, longer term 2-4 yrs.

High corn population and yields (>35,000 plts/ac), push K uptake and reduce root volume/plant. Adjust fertility accordingly.

KRx Prescription Potassium

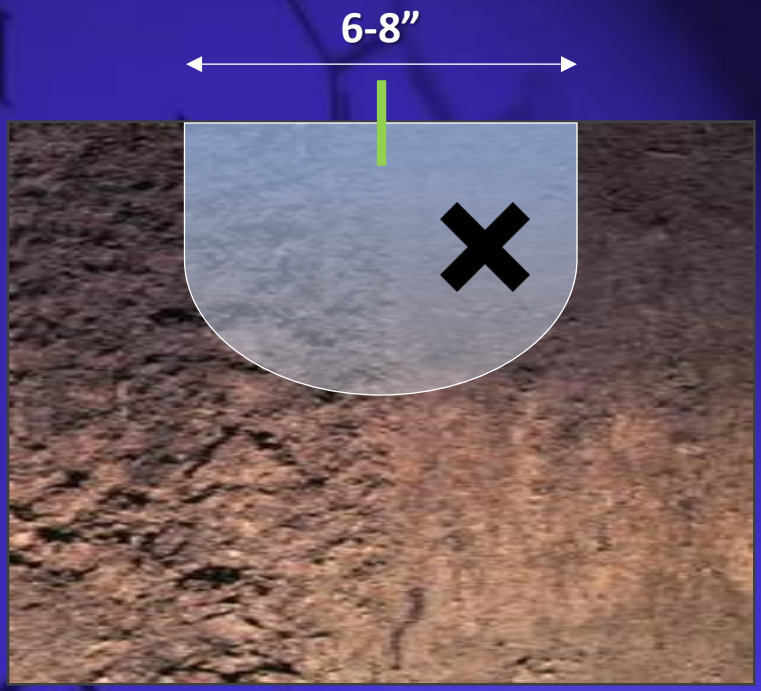
Miller, 2016

Fertility Management

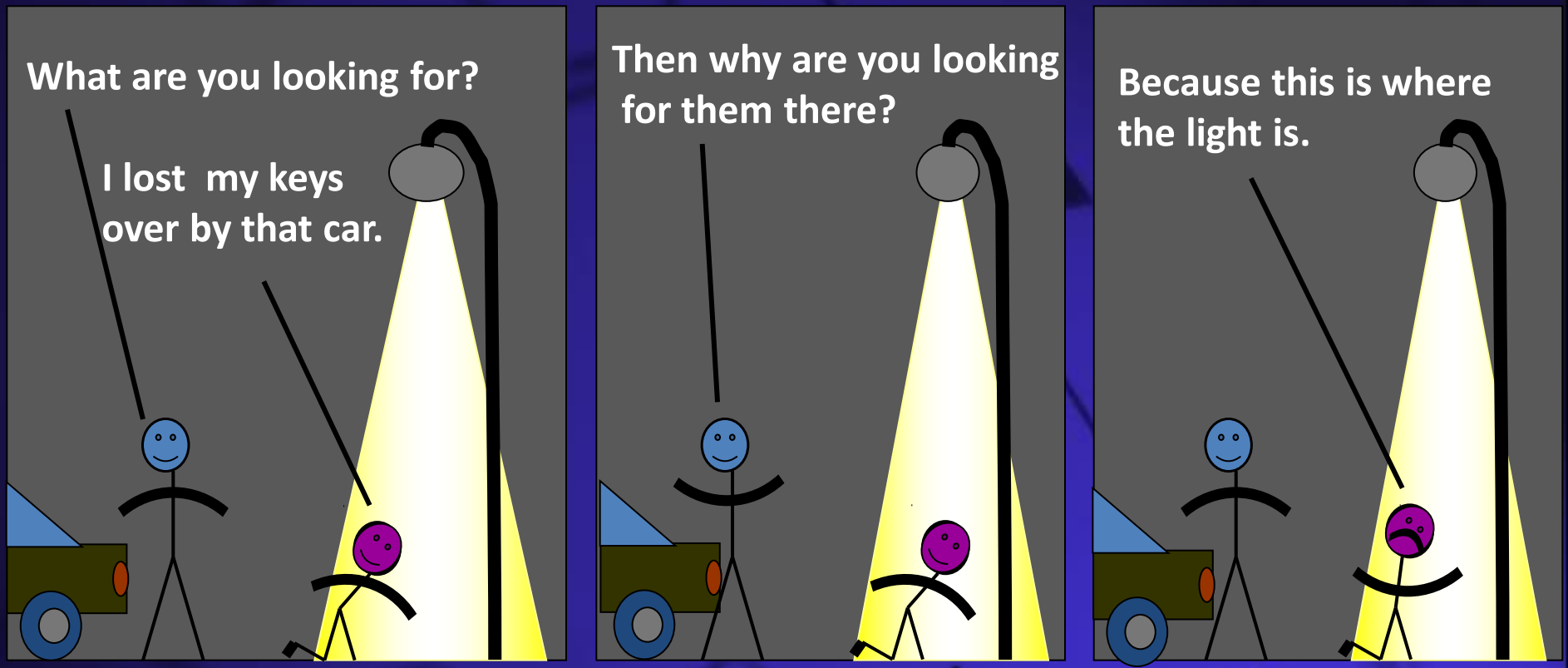
Recommendations

Reduce Till and strip till systems, pre-plant shallow incorporation in the row of dry K products or liquid materials applied to the 2x2 or 2x4 is preferred (x). A rate of 100 lbs/ac K applied in a 6” wide band (incorporated) achieves 500 lbs/ac in the row.

Side dress banding of liquid products (KCl, K_2SO_4 or K acetate) at V2-V5 is an option. Recommend spoke wheel or shallow incorporation. Adding small amount of N advised.



Miller, 2016



The fate of the scientist: Only searching where there is light… (or where we want to see).

Dr. Michael Rutzke, Ph.D.
Department of Crops & Soil Sciences, Cornell University Ithaca, NY

Sponsors

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Midwest Independent Soil Samplers LLC
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ALP


Thank you for your time
and attention

Corn Ear Leaf K Frequency Plot

Observations, GS VT-R1 Western Indiana

1.75 % K Purdue University, 2007

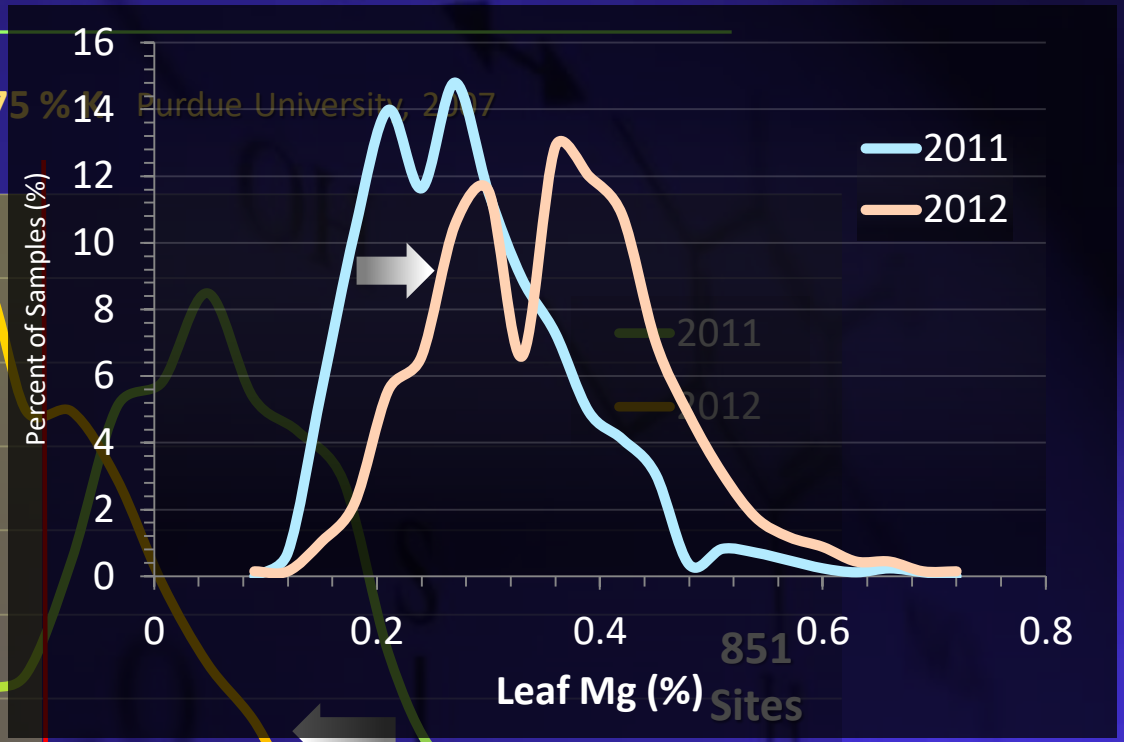
Deficient

Percent of Samples (%)

Leaf K (%)

0 2 4 6 8 10 12 14 16

0.5 1.0 1.5 2.0 2.5 3.0 3.5



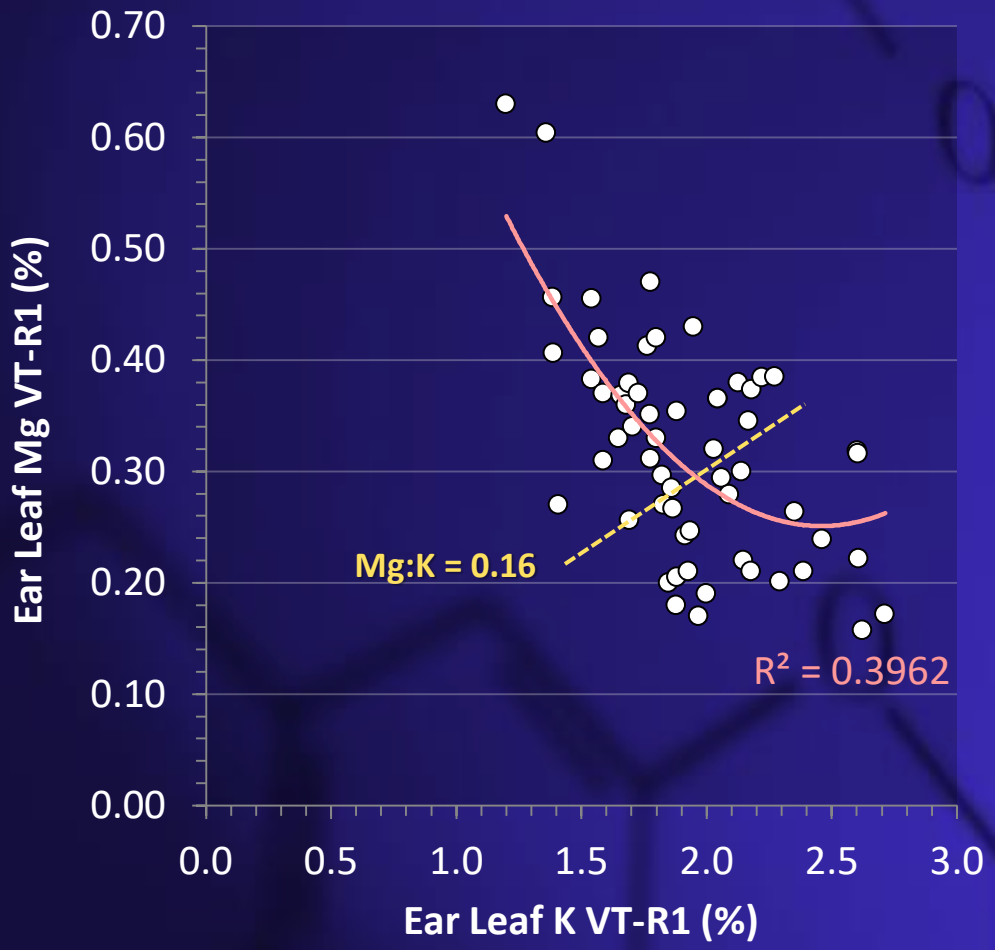
Source: Betsy Bower, Ceres Solutions
And Midwest Independent Samplers

CERES SOLUTIONS
Cultivating results.

Miller, Bower, & Smith, 2015

Corn Ear Leaf VT-R1 K vs Mg

60 K*Rx* sites, across seven states 2011-2015.



Variable Average	Cluster [3]	
	Low K	*High K*
Yield (bu/ac)	159	202
N %	2.92	2.89
K %	1.48	2.40
Mg %	0.42	0.29
Mg:K	0.29	0.12
N:K	1.99	1.20
N:Mg	7.3	12.1

[3] Clusters based on 12 sites each.

1 Each site represents the mean of 4 control plots.

2 Mg:K > 0.16 K deficient, Elwali ,1984 Agron J.

Miller et al, 2016

Recommendations

Assess sub soil K levels (2-6" or 2-8"). STK 100 - 120 indicate possible response, < 100 ppm likely response. Assess at 10-20% of grid points.

Plant Analysis. Ear leaf (VT-R1) K < 1.9%, Mg:K ratios > 0.16 and N:Mg ratios < 10 are indicative of K deficiencies. Track annually to assess K management effectiveness.

Focus K fertilizer: shallow band incorporation and side dress. Surface broadcast applications, ineffective. Don't expect to change STK or leaf K in 1 year, longer term 2-4 yrs.

High corn population and yields (>32,000 plts/ac), push K uptake and reduce root volume/plant. Adjust fertility.

KRx Prescription Potassium

Miller, 2016

Conclusions

Additional Research is planned for 2017 in IL ,IA, SD, WI and MN.

Results show side dress K response at 46% of 76 research sites, yield response 8 – 33 bu/ac in Midwest.

Optimum population was between 32k and 38k per acre. N x K treatment increased grain yields STK at 4 of 5 sites 2016. Response was anion independent.

Five years of data show grain yields are optimum when ear leaf K > 1.9%, ratios Mg:K < 0.15 and N:Mg ratios > 10. Sites outside these leaf ranges show significant limitations on yield.

Miller et al, 2016

K*Rx* K Corn Yield Response

Grain yield response to K at three sites, to application of K sulfate applied at V4-V5 using spoke wheel injector.

	Wisconsin Site		Illinois Site	
Treatment	Yield	Delta [2]	Yield	Delta [2]
(K lbs/ac)	bu/ac		bu/ac	
Check	203.4	-	147.7	-
50 K_{SO4}	216.7	+ 13.3*	156.2	+ 8.5
50 K_{SO4} + B[1]	215.2	+ 11.8*	162.2	+ 14.5*
25 K_{SO4} 2X	217.6	+ 14.2*	159.1	+ 11.4

[1] Wolf Trax Boron DDP at 0.6 lbs per acre of product (18.5% B).

[2] Significant at p 0.1 level, 8 reps.

Miller, et al, 2016

Continued

Tissue analysis?

Additional yield data for 2013 is being compiled from IN and IA locations.

Assessing leaf tissue concentrations based on lab analysis uncertainty, shows significant K relationships for N:K ratio across 3 years, and elevated by drought (2012). Decrease leaf K was highly correlated with increased leaf Mg and Ca, and increases with Mg:N and Ca:N ratios. Results support those of Elwali et al 1982, DRIS Norms.

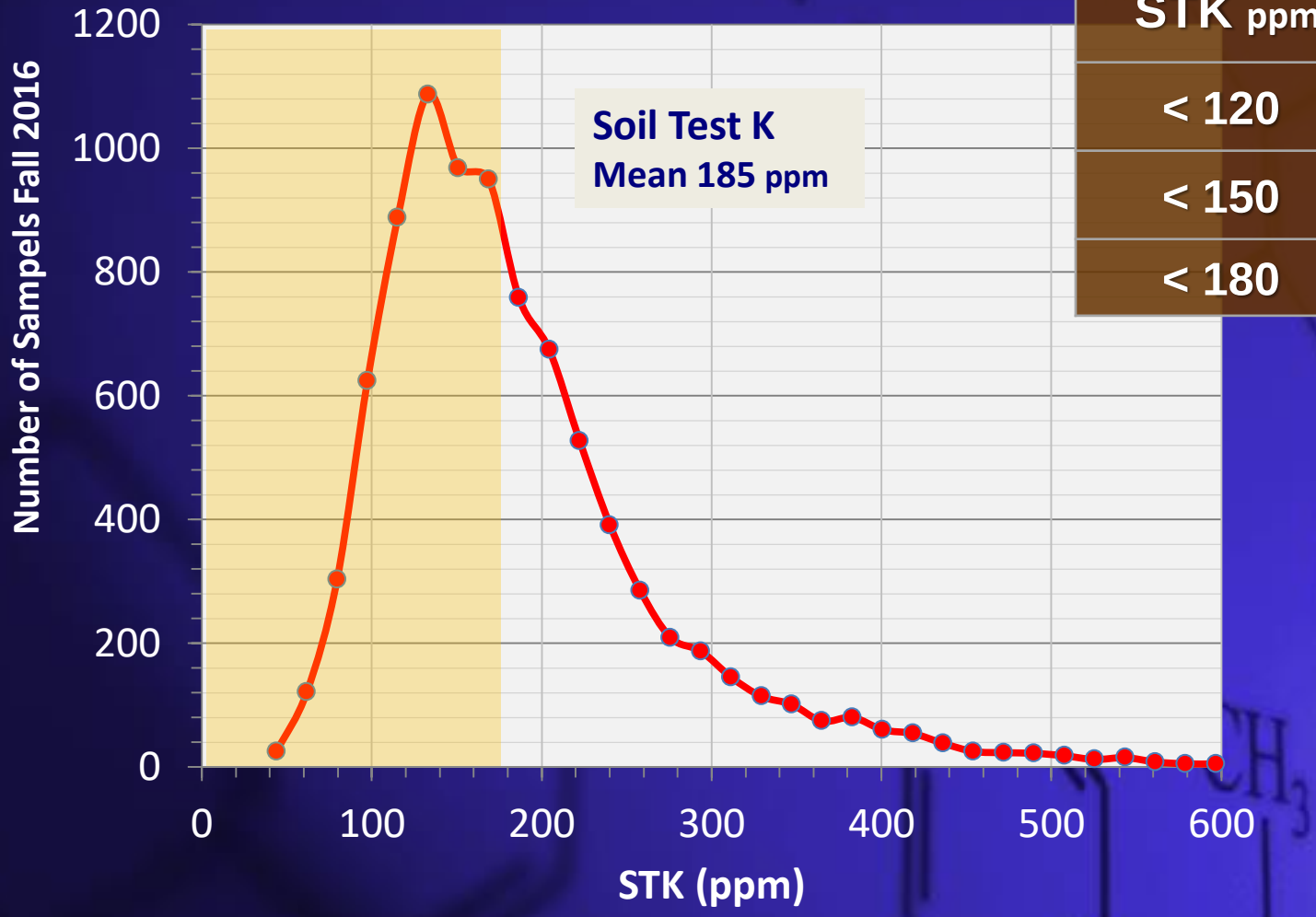
Results of K trials across the corn belt show K response on soils with 140 -290 ppm STK. Significant K stratification by depth was noted.

Sites with the highest N:K and Mg:N ratios show consistent lower grain yields. With K deficiency, due to low STK or soil moisture stress, ear leaf tissues show elevated Mg and suboptimal yields.

Miller , 2013

Soil Test K Eastern IA

Observations 8800 samples



STK ppm	2016
< 120	19.3 %
< 150	40.1 %
< 180	57.9 %

[1] Mehlich 3 K

Miller et al, 2016

KR_X: N x K Corn Yield Response

KR*x* Project Dodgeville, WI 2016

20 g increase on 1000 seed weight with N

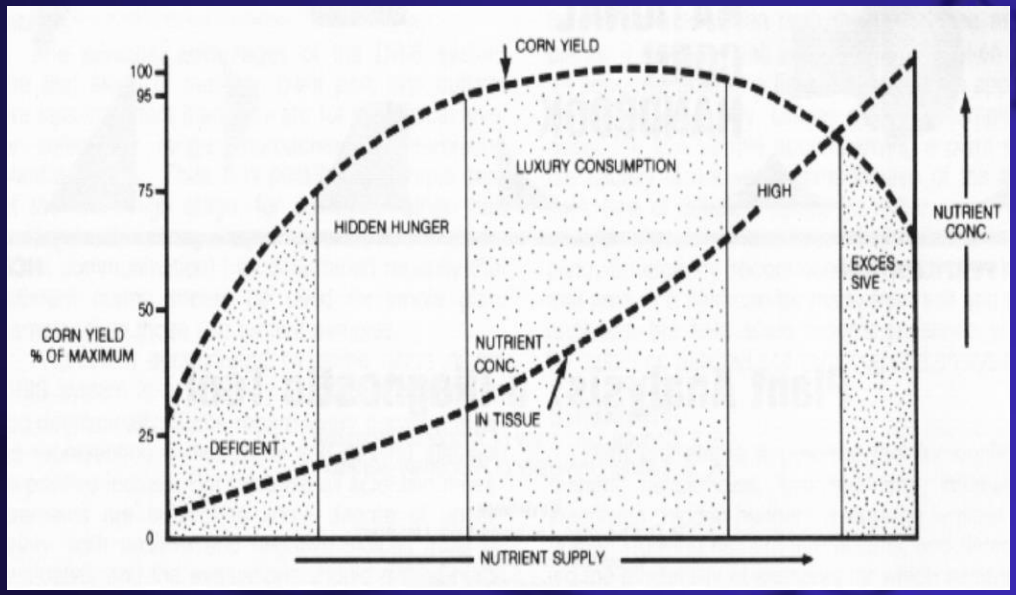
Population 32,900

Fertilizer: UAN 32 and K acetate (Nachurs); applied spoke wheel injector at V3-V4 growth stage, 2-3" depth, 4" both sides of row, eight replications. Soil STK 182 ppm.

* Yield significant at the 0.10 level, corn 15.5% moisture.

Miller et al, 2016

Plant Nutrition



http://www.extension.purdue.edu/extmedia/nch/nch-46.html Adapted from Brown, J. R. 1970. Plant analysis. Missouri Agr. Exp. Sta. Bull. SB881

Plant nutrient content has been classified in five ranges as it relates to yield.

Corn ear leaf nutrients at growth stage VT represent a synopsis of plant nutrition at the end of the vegetative growth.

Miller et al, 2016

Miller, 2016

KR_x Corn Yield Response

KR*x* Project Yield Results 2012
six Illinois, Indiana and Nebraska sites.

Site	STK	Check	+K	Increase
Cty / State	lbs/ac	bu/ac		
Merrick, NE	300	169	170	+ 1
Vermillion, IL	262	174	176	+ 2
Livingston, IL	284	89	88	- 1
Piatt, IL	610	141	154	+ 13*
Sullivan, IN	232	94	110	+ 16
Warsaw, IN	296	73	67	- 6

* Yield significant at the 0.10 level, corn 15.5% moisture.
STK 0-6" Depth

K effect on ear size

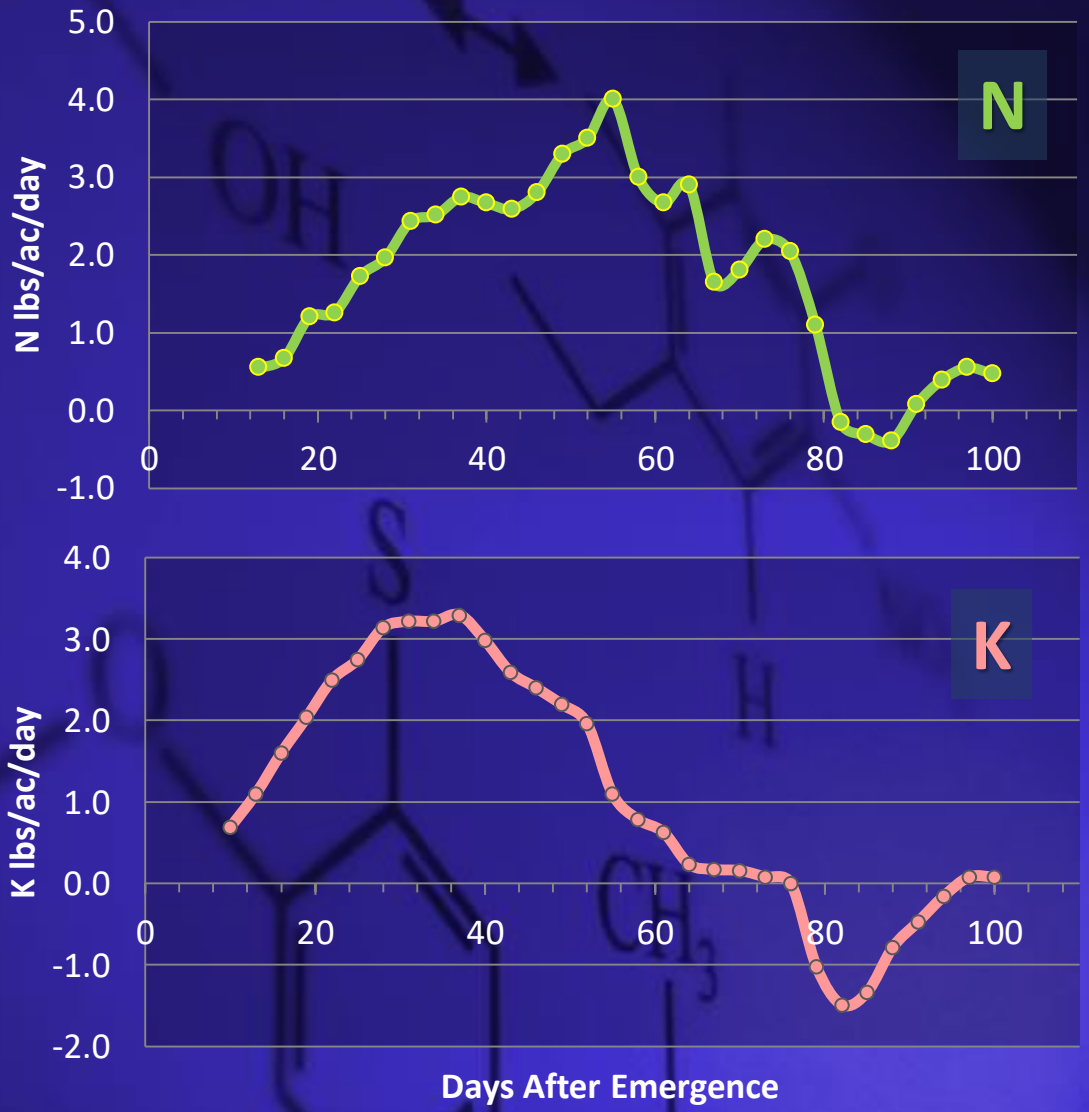
K increased yield on a soil STK > 300 lbs/ac

Corn Growth: Sayre – 1948 [1]

The N accumulation rate was maximum at pollination, at a rate of 4.0 lbs/ac/day.

The K accumulation rate was maximum at 28 days at an average rate of 3.2 lbs/ac/day, lasting for 12 days.

Peak K accumulation rate proceeded peak N uptake by 10 days, and decreased to near zero at 64 days.



[1] Calculated from Sayre, 1948, Plant Phys. 23-267-281 Wooster, OH 1940.

Miller, 2013

University of Illinois Publication

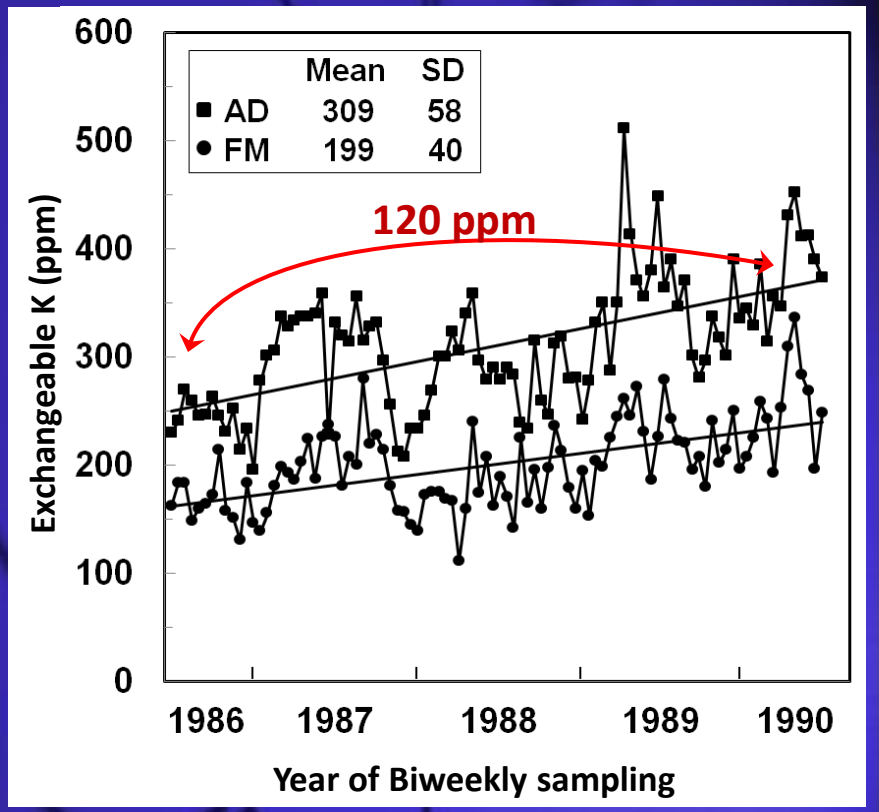
The potassium paradox: Implications for soil fertility, crop production and human health

S.A. Khan*, R.L. Mulvaney and T.R. Ellsworth

Department of Natural Resources and Environmental Sciences, University of Illinois at Urbana-Champaign, 1102 S. Goodwin Avenue, Urbana, IL 61801, USA.
*Corresponding author: potassiumparadox@gmail.com

"Khan and Mulvaney see no value in soil testing for exchangeable K and instead recommend that producers periodically carry out their own strip trials."

University of Illinois, October 28, 2013
AgProfessional.com/News



Miller , 2016

Soil Test K Declines?

http://img.photobucket.com/albums/v423/Suzanne57/harvest-field-blog.jpg

Crop Removal Variability

Corn: 0.24 ± 0.035 K_2O lbs/bu

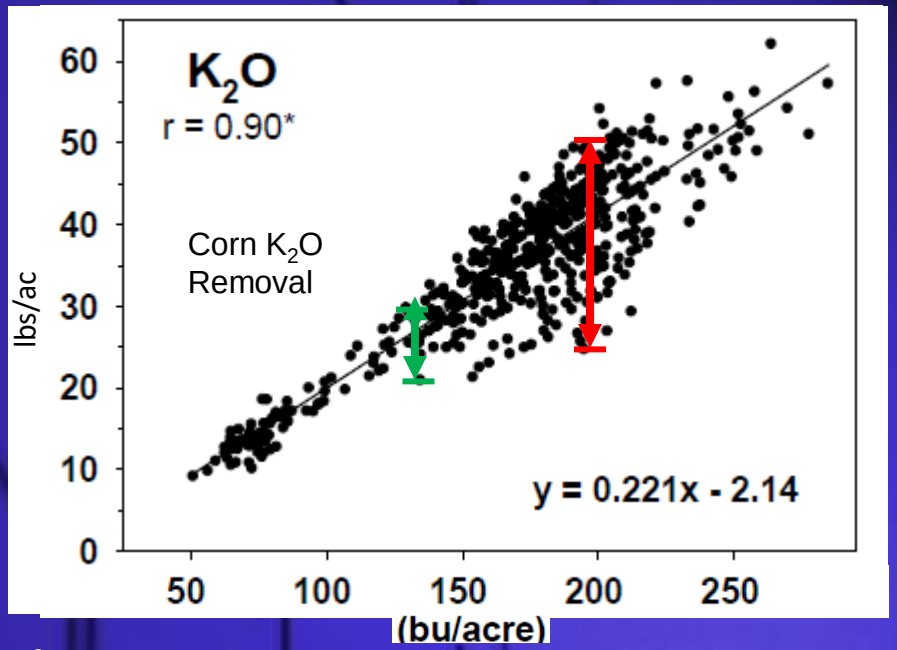
Soybeans: 1.23 ± 0.16 K_2O lbs/bu

Crop[1]	Yield bu/ac	Low K_2O lbs/ac/yr	High K_2O lbs/ac/yr
Corn	200	41	57
Soybean	60	64	84
Total		105	141

Assumes 100% dry matter, 0.0% moisture.

Four year rotation 246 ± 36 K_20 lbs/ac

Corn grain K_2O removal becomes more variable with increased yield.



[2] Binford, 2008

[1] Based on removal rates from Brouder, 2009, Purdue, University.