

P & K Response in No-till Corn & Soybean Production



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Sensitivity of Soybean to Low STK

STK = 60 ppm in row

STK = 55 ppm between rows



Photo credits: Mike Ballweg

Site & Treatments

- Saybrook silt loam
 - Moderately well-drained
 - Mollisol
- Site 602S, established in 2011
 - 8 ppm P; 59 ppm K
- Site 602C, established in 2012
 - 1 ppm P; 48 ppm K
- No-till; previous crop was alfalfa
- Treatments broadcast applications
 - 5 rates of K_2O (0 – 160 lb K_2O/a) at each of
 - 4 rates of P_2O_5 (0 – 90 lb P_2O_5/a)
 - Treatments applied to same plots in spring of each year
- Rotation established with soybean in 2011 and 2012



pH 7.1; 3.9% OM

Optimum STK = 101-130 ppm

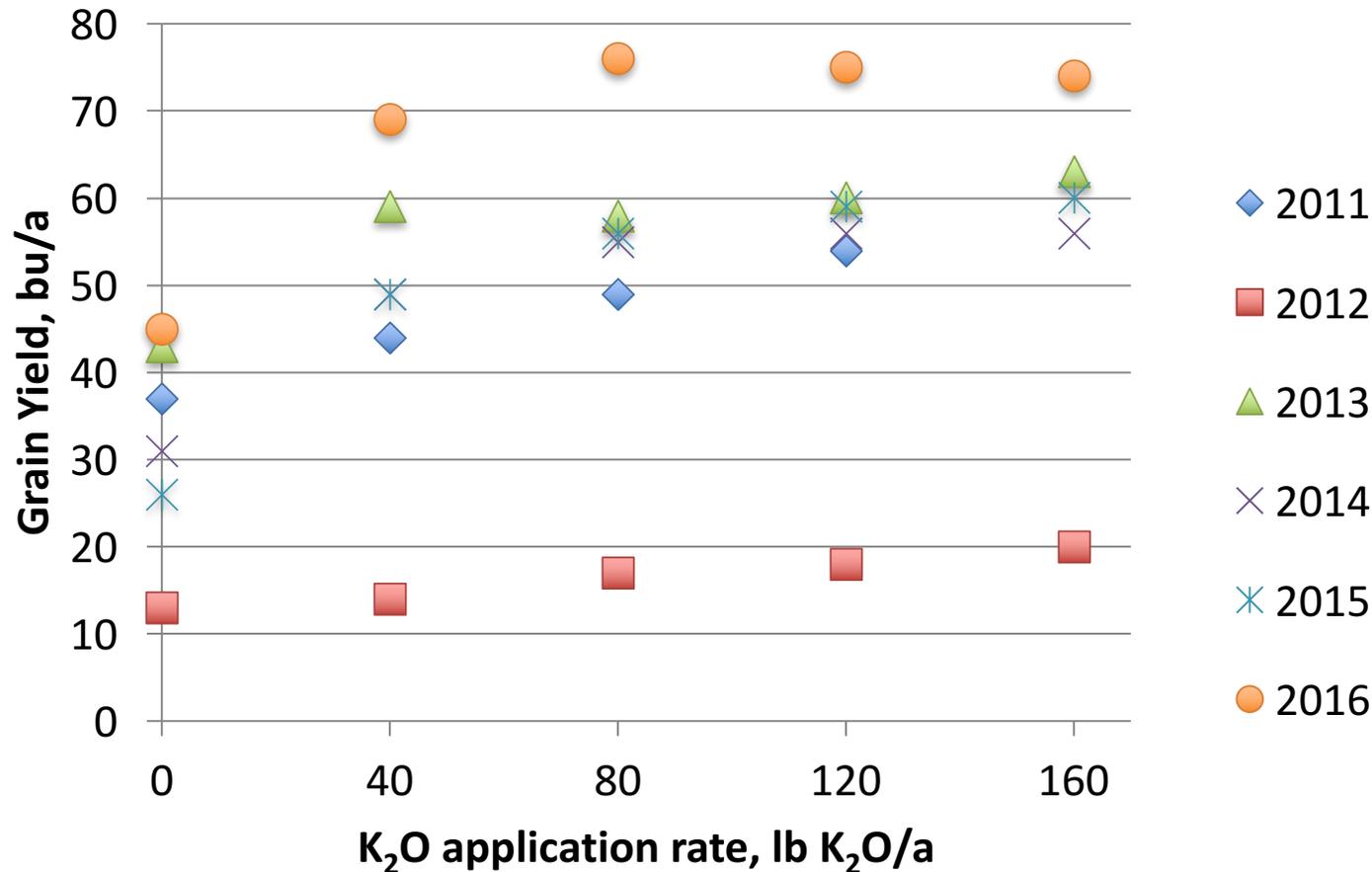
Optimum STP = 16-20 ppm



8/22/14



No-till **SOYBEAN** yield response to K fertilizer application



Excluding 2012:

- Mean yield increase = 25 bu/a
- Soil supplied 43 to 68% of total yield

Effect of spring surface broadcast P₂O₅ and K₂O for 5 consecutive years

2016 SOYBEAN grain yield

P ₂ O ₅ rate	K ₂ O rate, lb/a					
	0	40	80	120	160	Mean
lb/a	----- bu/a -----					
0	49 C	69 B	73 bA	69 bB	71 bB	66
30	43 B	70 A	74 bA	75 aA	74 aA	67
60	47 C	67 B	76 abA	75 aA	76 aA	68
90	41 C	68 B	80 aA	79 aA	76 aA	69
Mean	45 C	69 B	76 A	75 A	74 A	

Crop removal at 60 bu/a:
85 lb K₂O/a
50 lb P₂O₅/a

- ✓ Even though initial STP was very low, only P response in soybean was in 2016 where STK was > 78 ppm
- ✓ No P response in any other year, even though STK was > 78 ppm in some treatments in 2013 to 2015.

June 2013

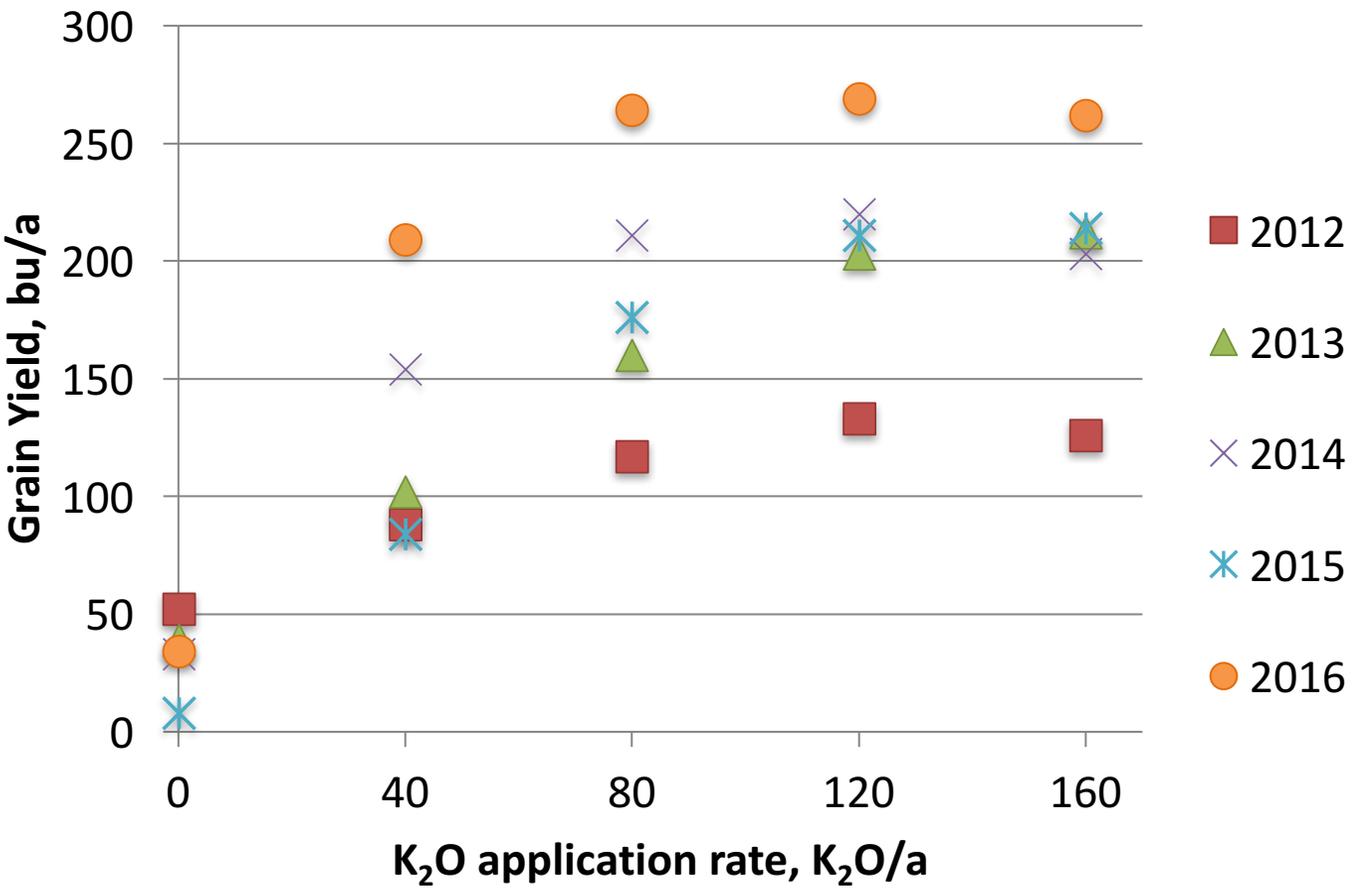


7/11/14



6/13/14

No-till **CORN** yield response to K fertilizer application



Excluding 2012:

- Mean yield increase = 200 bu/a
- Soil supplied 4 to 18% of total yield

Effect of spring surface broadcast P₂O₅ and K₂O for 4 & 5 consecutive years on **2014 & 2016 CORN** grain yield

2014							2016					
P ₂ O ₅ rate	K ₂ O rate, lb/a						K ₂ O rate, lb/a					
	0	40	80	120	160	Mean	0	40	80	120	160	Mean
lb/a	----- bu/a -----						----- bu/a -----					
0	40 C	156 B	194 b A	192 c A	190 A	155	42	218	254	246	245	201
30	28 C	150 B	215 ab A	211 b A	204 A	162	31	202	272	261	259	205
60	27 C	152 B	230 a A	235 a A	210 A	171	31	214	271	284	273	214
90	36 D	157 C	205 b B	243 a A	208 B	170	32	201	260	285	273	210
Mean	33	154	211	220	203		34 C	209 B	264 A	269 A	262 A	

If ≥ 80 lb K₂O/a/yr was applied, then AOPR = 50 lb P₂O₅/a
 AOKR = 92 lb K₂O/a

P response also occurred in 2015 at 160 lb K₂O/a annually where spring STK averaged 87 ppm

Spring STK before K application (3 consecutive applications)

2014: 53 ppm 60 65 76 91

ΔSTK response to P

No-till **CORN** biomass (R6) yield

- Significant response to K
 - K rate that maximized yield was the same or less than K rate that maximized grain yield
- No significant response to P
 - However, trends in 2014, 2015, & 2016 suggest yield increased with P application when K application was ≥ 120 lb K_2O/a

**Bucky likes to soil sample.
Be like Bucky.**



Effect of 5 consecutive P & K applications on **soil test P** level in spring 2016 (field 602S)

P ₂ O ₅ rate	K ₂ O rate, lb/a					
	0	40	80	120	160	Mean
lb/a	----- STP, ppm -----					
0	7	6	6	5	5	6 d §
30	13	10	11	7	7	10 c
60	23	16	15	17	12	16 b
90	39	27	31	30	19	29 a
Mean	21 a	15 b	16 b	15 b	11 c	

P₂O₅ rate $p < 0.01$. K₂O rate $p < 0.01$. P₂O₅ rate x K₂O rate $p = 0.20$. CV = 33%.

Effect of 5 consecutive P & K applications on **soil test K** level in spring 2016 (field 602S)

P ₂ O ₅ rate lb/a	K ₂ O rate, lb/a					
	0	40	80	120	160	Mean
	----- STK, ppm -----					
0	69	64	80	105	102	84
30	61	70	74	90	110	81
60	64	74	76	93	110	83
90	61	62	81	99	106	82
Mean	63 d §	67 d	78 c	97 b	107 a	

P₂O₅ rate $p < 0.83$. K₂O rate $p < 0.01$. P₂O₅ rate x K₂O rate $p = 0.73$. CV = 15%.

Summary

- K is more limiting to corn & soybean production than P
 - Corn responded to P in 2014 & 2015 once soil test K levels were at > 65 ppm or 81 ppm, respectively
 - Soybean responded to P in 2016 when STK >78 ppm
- When STK is very low, K fertilizer supplied,
 - 32 to 57 % of total soybean yield
 - 82 to 96 % of total corn grain yield
- When STP is very low, P fertilizer supplied (if adequate K),
 - 13 % of total soybean yield
 - 20 % of total corn grain yield
- Lower STK resulted in lower yield and more rapid increase in STP when P is applied
- P application did not influence STP

Pay attention to K !!!

Thank you!

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<http://ipcm.wisc.edu/>

<https://youtube.com/user/uwipm>