Soil Test K: Recent Revelations

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CHANGES IN SOIL TEST K OVERWINTER

Is this really a big deal?

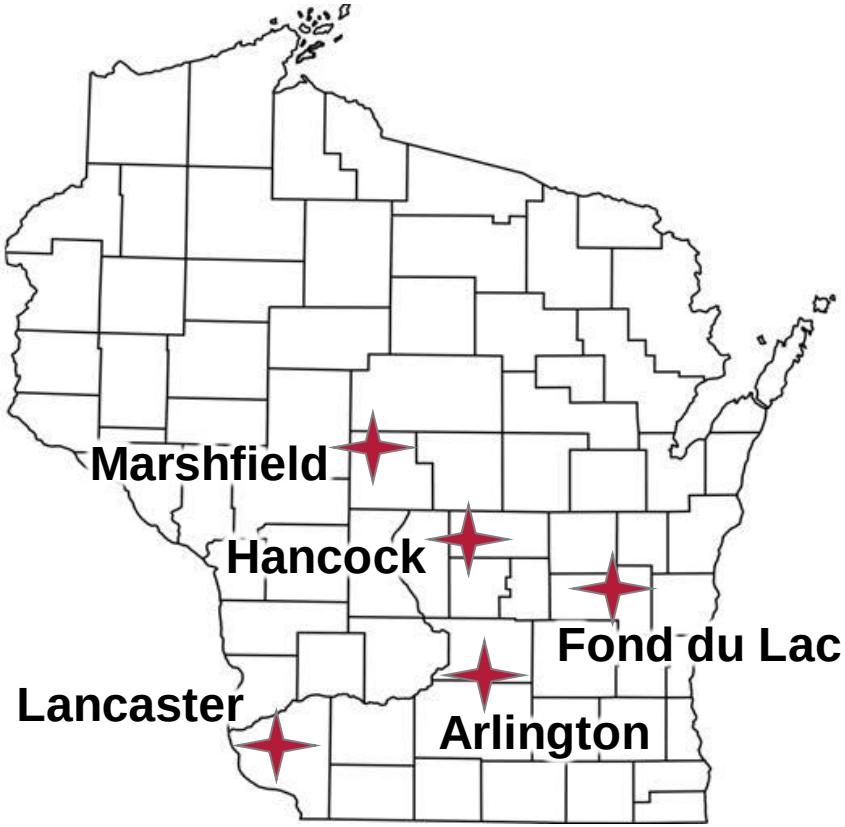
- Past research has shown that wetting/drying, freezing/thawing, redox, and sample handling can affect STK
  - Both↑and↓STK, dependent on clay minerals
- UW soil sampling guidelines
  - Sample at the same time of year
- What happens if fall soil sampling is delayed until spring?

Objective

- To assess the effects of corn silage vs. grain removal and different STK levels on overwinter changes in STK

Potassium experiment 2006-2008

- Corn (grain/silage)-soybean-corn (grain/silage) rotation
- K fertilizer rates applied spring 2006 only:
  - 0, 66, 134, 200, 266, 333, and 400 lb K_2O/a at all locations except Fond du Lac, which only received the lesser four K rates
- Soil sampled post harvest and spring preplant
  - 0-8”
  - Dried, ground, Bray K

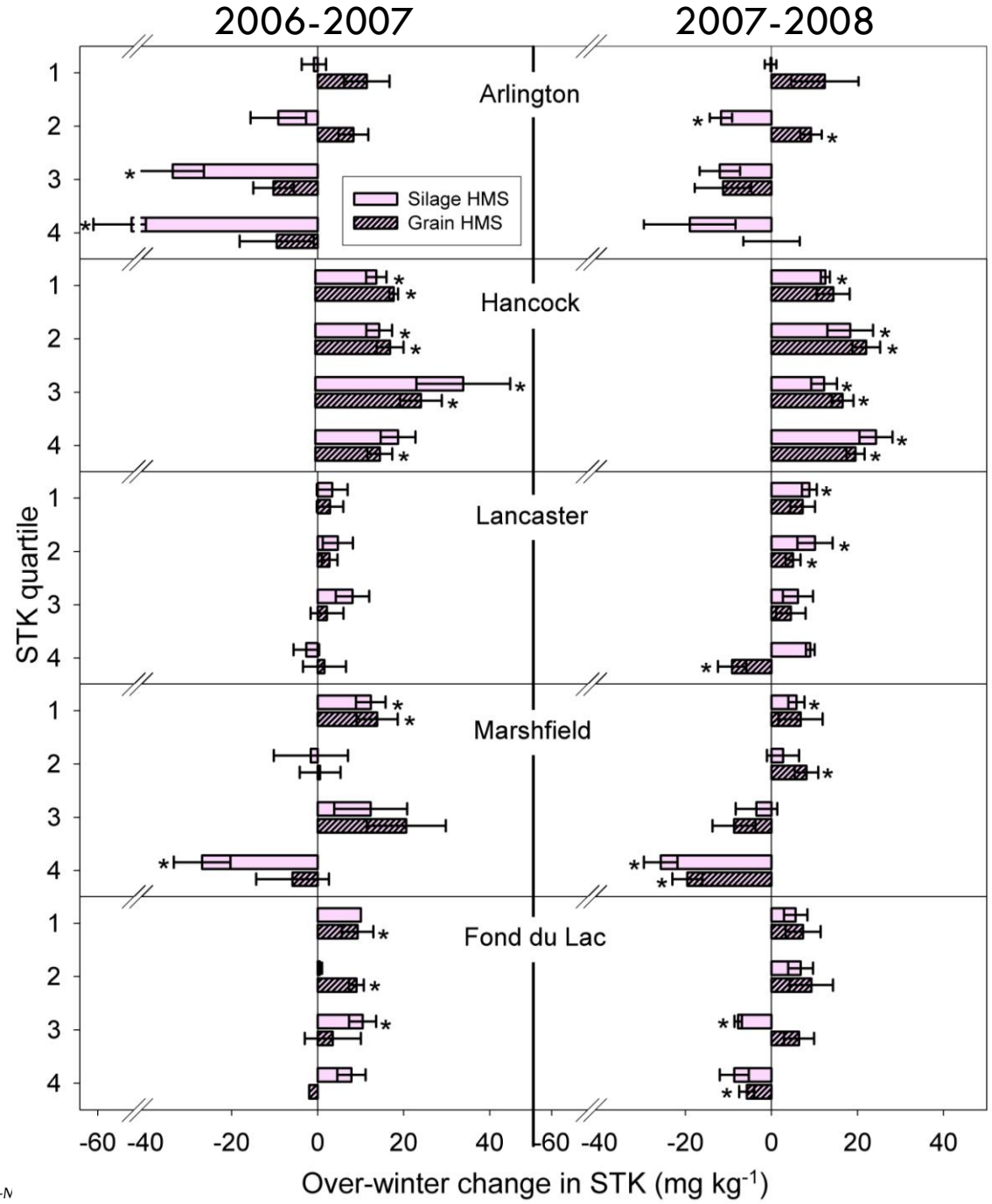


Calculations

- Overwinter change in STK =

  spring STK – fall STK

- At each location, plots were divided into 4 groups (quartiles) based on STK
  - 1 = lowest STK
  - 4 = highest STK



- At Arlington & Marshfield STK decreased over-winter for greater STK quartiles and increased over-winter for lesser STK quartiles
- Hancock – consistent and significant increase of 25 ppm over-winter; small range in STK; can't be explained by mineralogy
- STK at Lancaster & Fond du Lac mostly increased over-winter 2006-2007; more decreases in 2007-2008
- In the 2006-2007 over-winter period, Arlington only loc. Where HMS significantly effected change in STK; likely because of greater K uptake at this locations

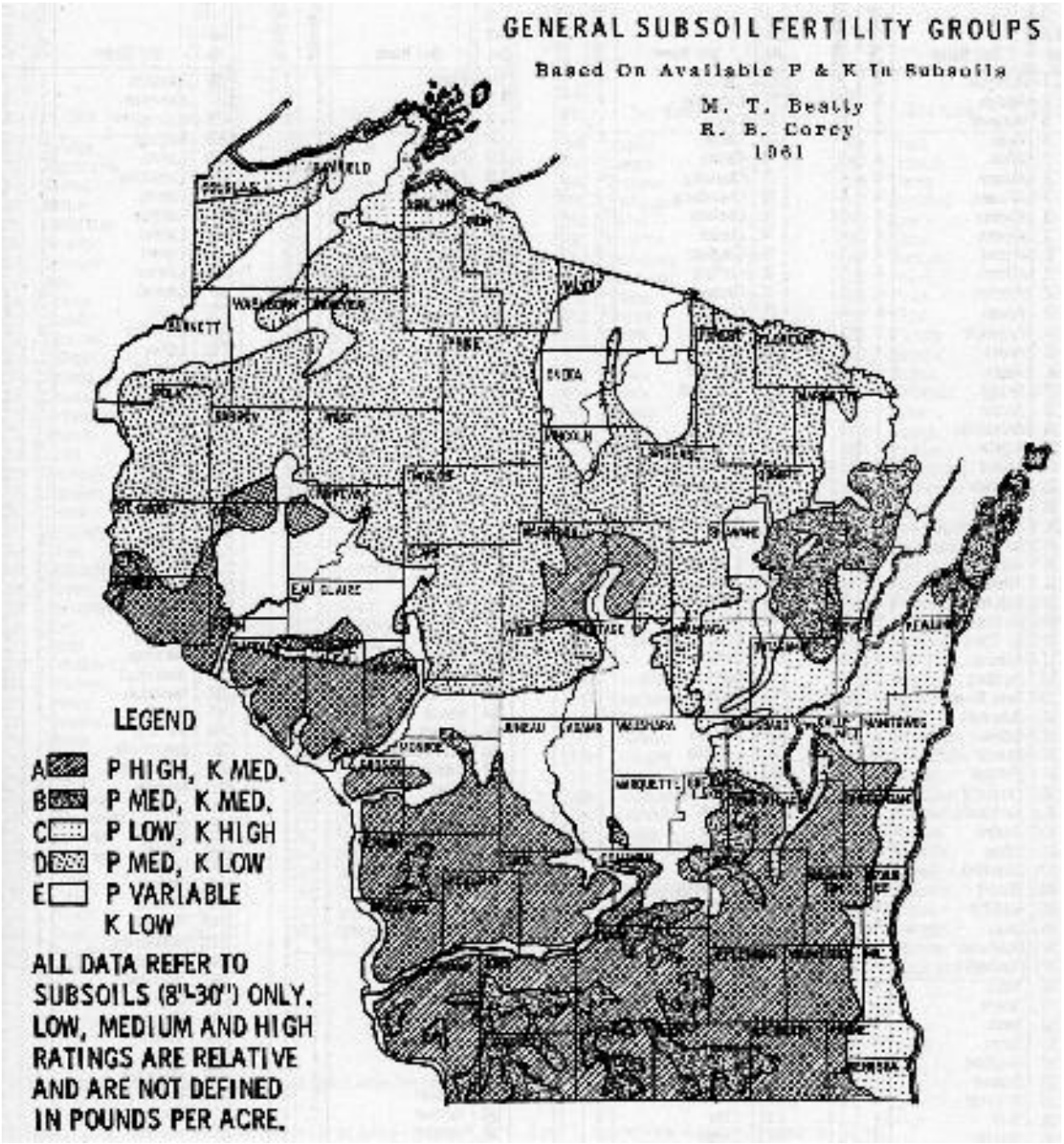
Summary

- At higher STK levels, K can be fixed over-winter, HOWEVER
  - Magnitude of fixation (if it occurred) was dependent on:
    - Clay mineralogy & actual STK levels
    - Year
    - Corn silage vs grain harvest
- When reviewing historical STK data be aware that time of sampling is influential

CHANGES IN SUBSOIL FERTILITY

Background

- Subsoil groups are the underpinning of P and K fertilizer recommendations
- History of subsoil groups dates to the late 1950's
- Beatty & Corey (1962) reported on a subsoil (8-20") survey conducted on various soil types throughout the state of Wisconsin


GENERAL SUBSOIL FERTILITY GROUPS
Based On Available P & K In Subsoils
M. T. Beatty
R. B. Corey
1961
LEGEND
A P HIGH, K MED.
B P MED, K MED.
C P LOW, K HIGH
D P MED, K LOW
E P VARIABLE
K LOW
ALL DATA REFER TO SUBSOILS (8'-30') ONLY. LOW, MEDIUM AND HIGH RATINGS ARE RELATIVE AND ARE NOT DEFINED IN POUNDS PER ACRE.

Research Question

- Are subsoil fertility groups still valid after 50 years of cropping?

Effect of long-term rotation on soil test P and K levels at Lancaster (Fayette sil)

Sequence	---------- Soil Depth ----------			
	0-6"	6-12"	12-24"	24-36"
	------- Soil test P (ppm) -------			
CC	17	11	23	39
CS	27	9	17	42
CCOAA	25	10	21	46
	------- Soil test K (ppm) -------			
CC	122	79 b§	100 a	110
CS	145	90 a	93 b	108
CCOAA	202	77 b	92 b	114

§ Significant at the P≤0.10 level.

CC = continuous corn
CS = corn-soybean
CCOAA = corn-corn-oat-alfalfa-alfalfa

Rotations established in 1965, except CS established in1987.
Recent sampling occurred in 2009.
No deep samples were collected in 1965.

Effect of cropping system on soil test P in the WICST plots at Arlington (Plano sil)

System/trt	Sequence	Year	Soil Depth 0-6"	6-12"	12-24"	24-36"
			Soil test P (ppm)			
CS1/1	CC	1989	105 a§	65 a	29	48
		1996	91 ab	43 b	29	
		2001	85 b	43 b	28	51
		2007	59 c	29 b	25	51
CS2/3	CS	1989	98 a	43 a	24	51
		1996	66 b	30 b	28	
		2001	57 b	38 a	23	53
		2007	37 c	22 c	23	46
CS4/7	CAAA	1989	115 a	46	35	57
		1996	90 ab	47	31	
		2001	95 a	52	29	48
		2007	66 b	38	31	55

All systems, net P additions are negative

§ Significant at the P≤0.10 level.

Effect of cropping system on soil test K in the WICST plots at Arlington (Plano sil)

System/trt	Sequence	Year	Soil Depth 0-6"	6-12"	12-24"	24-36"
			Soil test K (ppm)			
CS1/1	CC	1989	257 a§	143 a	125 a	135 a
		1996	257 a	100 b	74 c	
		2001	194 b	83 b	88 b	121 ab
		2007	204 b	81 b	89 b	112 b
CS2/3	CS	1989	199 a	121 a	134 a	155 a
		1996	214 a	91 b	83 c	
		2001	126 b	90 b	99 b	118 b
		2007	121 b	75b	92 bc	103 c
CS4/7	CAAA	1989	277 a	123 a	126 a	131 a
		1996	180 b	81 b	80 b	
		2001	127 b	68 bc	82 b	96 b
		2007	131 b	60 c	76 b	100 b

All systems, net K additions are negative

§ Significant at the P≤0.10 level.

Effect of cropping system on soil test P in the WICST plots in Walworth Co. (Pella/Griswold sil)

System/trt	Sequence	Year	---------- Soil Depth ----------			
			0-6"	6-12"	12-24"	24-36"
			------- Soil test P (ppm) -------			
CS1/1	CC	1989	66	39 a§	13	8
		1996	61	31 ab	15	
		2001	58	22 b	10	9
CS2/3	CS	1989	59	24 a	9	6
		1996	41	14 b	7	
		2001	49	13 b	8	5
CS4/7	CAAA	1989	76	39	10	8
		1996	67	21	7	
		2001	79	18	11	11

§ Significant at the P≤0.10 level.

CC and CS, net P additions are negative

Effect of cropping system on soil test K in the WICST plots in Walworth Co. (Pella/Griswold sil)

System/trt	Sequence	Year	---------- Soil Depth ----------			
			0-6"	6-12"	12-24"	24-36"
			------- Soil test K (ppm) -------			
CS1/1	CC	1989	196 a§	134	126	124
		1996	191 a	105	114	
		2001	144 b	113	127	129
CS2/3	CS	1989	178 a	118	126	115
		1996	132 b	86	103	
		2001	93 c	105	125	102
CS4/7	CAAA	1989	216 a	148 a	143 a	128
		1996	163 b	88 b	95 c	
		2001	109 c	98 b	125 ab	121

§ Significant at the P≤0.10 level.

CC and CS, net K additions are negative

Conclusions???

- Subsoil K levels may decrease overtime in CC, CS, and CAAA rotations if crop removal exceeds K applications
  - Effect is location specific and may be a result of different initial STK levels, soil type, and crop management
  - Subsoil P levels appear to be unaffected
- Now have more questions regarding the validity and long-term implications of following current UWEX nutrient application guidelines for K
  - However, at this time there is not enough information to offer alternative strategies
  - Need more to fully understand K availability and redistribution in the soil under various cropping systems and fertilization strategies