



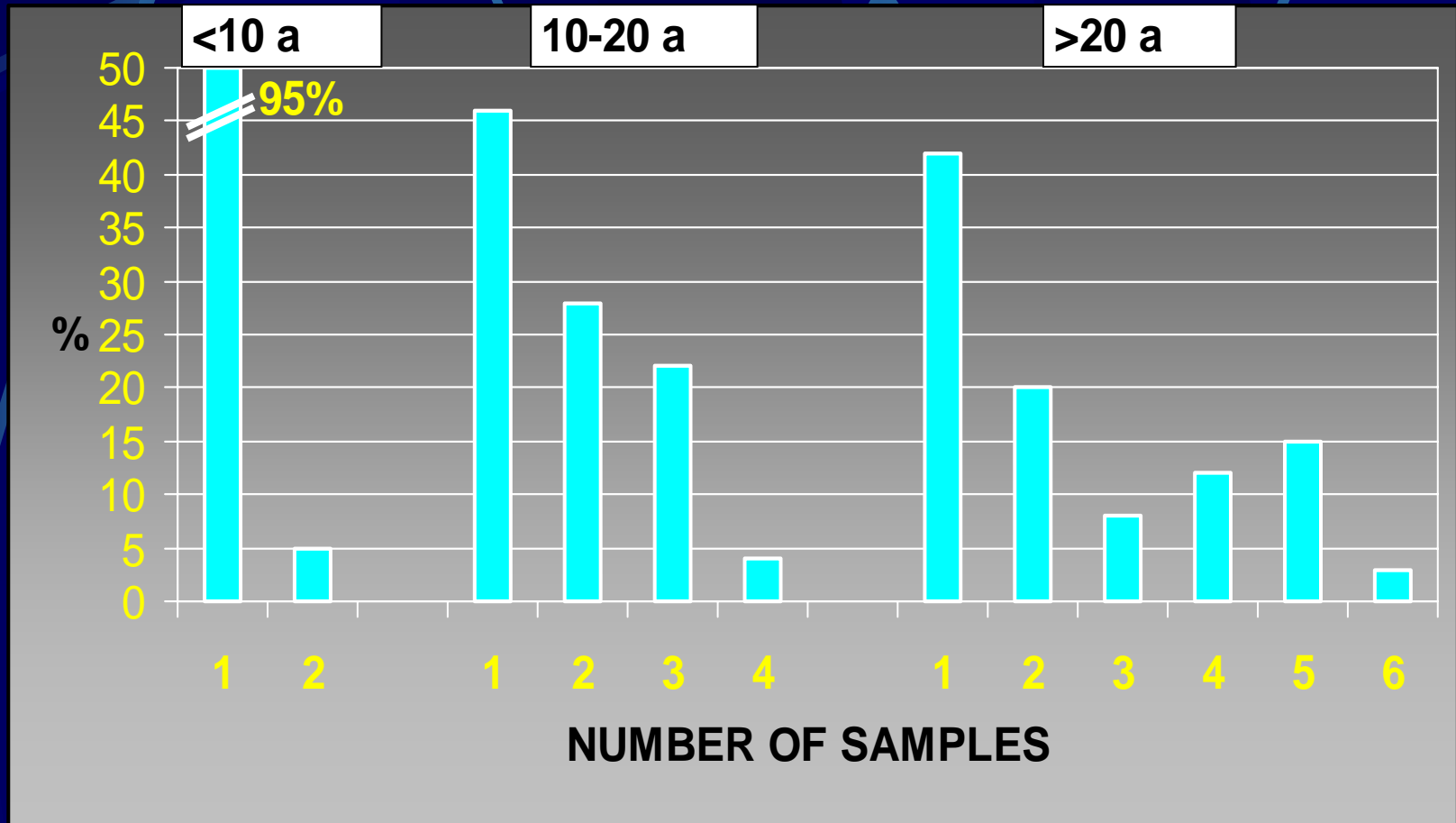
# Why is Soil Sample Depth Important

Dick Wolkowski  
Extension Soil Scientist  
UW-Madison

# The Purpose of Soil Sampling

- Determine the nutrient and lime need of fields to optimize profitability and preserve environmental quality
- Identify the “central tendency” of nutrient levels **OR** assess and manage spatial variability of soil test in fields
- Monitor effects of nutrient application over time
- The only preplant nutrient diagnostic tool
- Increasingly becoming a regulatory index

# 1999 SPAL Survey - 912 Reports (Kelling And Peters)

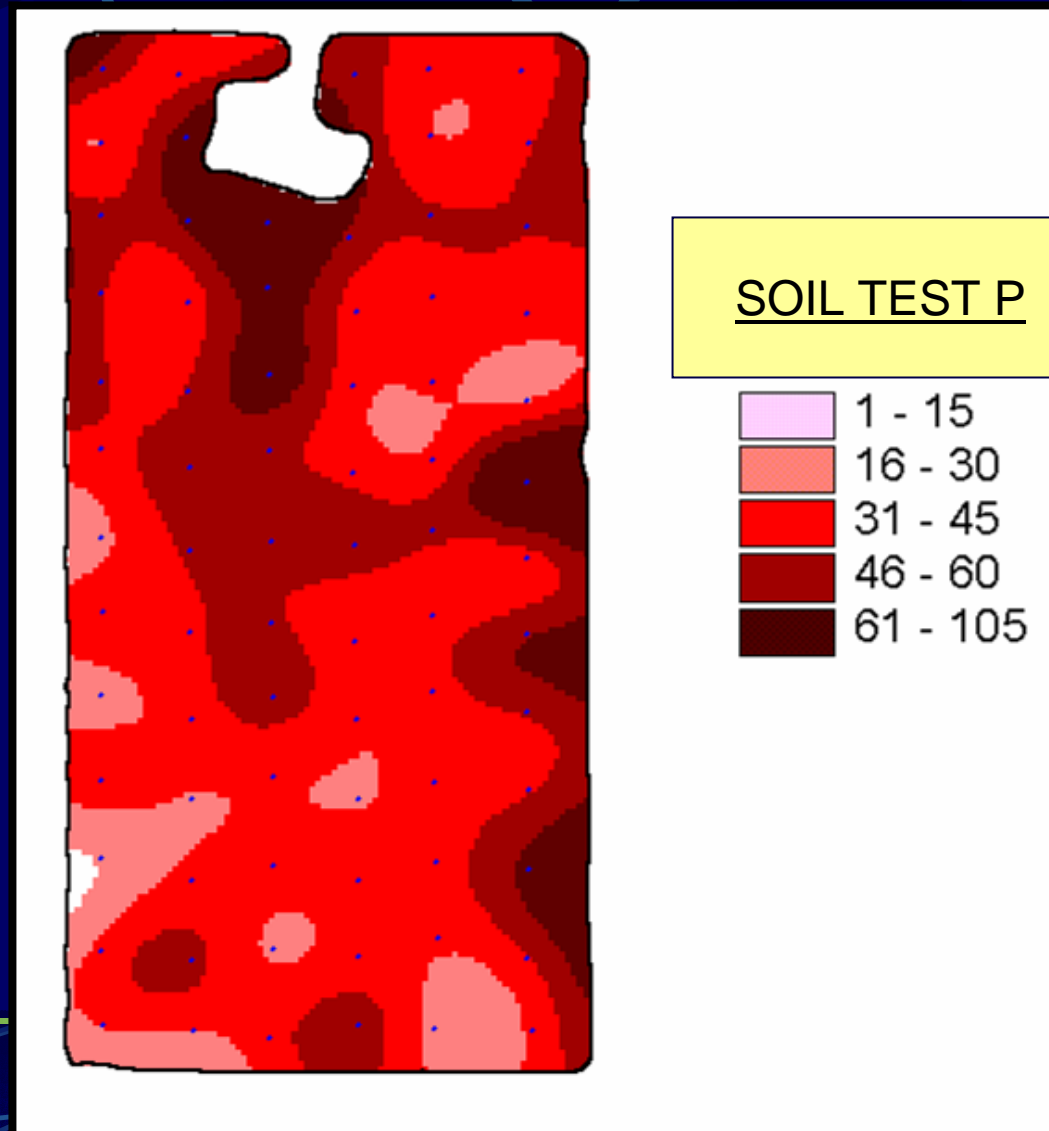


# Describing Soil Test Variability

VARIABILITY CLASS	DISTANCE	SOURCE
MICRO	< 2"	PEDS vs. PORES MICRO MORPH.
MESO	2" – 6'	FERT. BANDING CROP ROWS
MACRO	> 6'	LANDSCAPE FIELD MGT.

# Have We Paid Too Much Attention to X and Y, But Not Z

Soil test P distribution in a Rock Co. field



# Current Sample Depth Recommendations

- Moldboard plowing
  - Depth of tillage
- Chisel plowing or offset disking
  - $\frac{3}{4}$  depth of tillage
- No-till
  - 6-7 in.
  - 0-2 in. sample for pH in long-term no-till
- Influence of soil moisture condition and consistency between samplers ??



## King Kong vs. Mickey

It wouldn't be a fair fight,  
so could we expect them  
to take samples similarly



# Incremental Soil Sampling Comparisons

- Arlington tillage x rotation x fertilizer placement study. Started in 1997.
  - Chisel, strip-till, no-till
  - Continuous corn, corn/soybean
  - w/ or w/o broadcast (200 lb 9-23-30)
- 9 cores to 8 inches in 2 inch increments over four replications in 2005
- Examine effects of 4, 6, 8 in. sample depth
- Plano silt loam (subsoil group B)



# Incremental Soil Sampling Comparisons

- Lancaster tillage x fertilizer placement study. No-till for 10+ years, 2 chisel, 1 moldboard.
  - Corn/soybean
  - Sampled the unfertilized plots
- 9 cores to 8 inches in 2 inch increments in single rep
- Rozetta silt loam (subsoil group A)

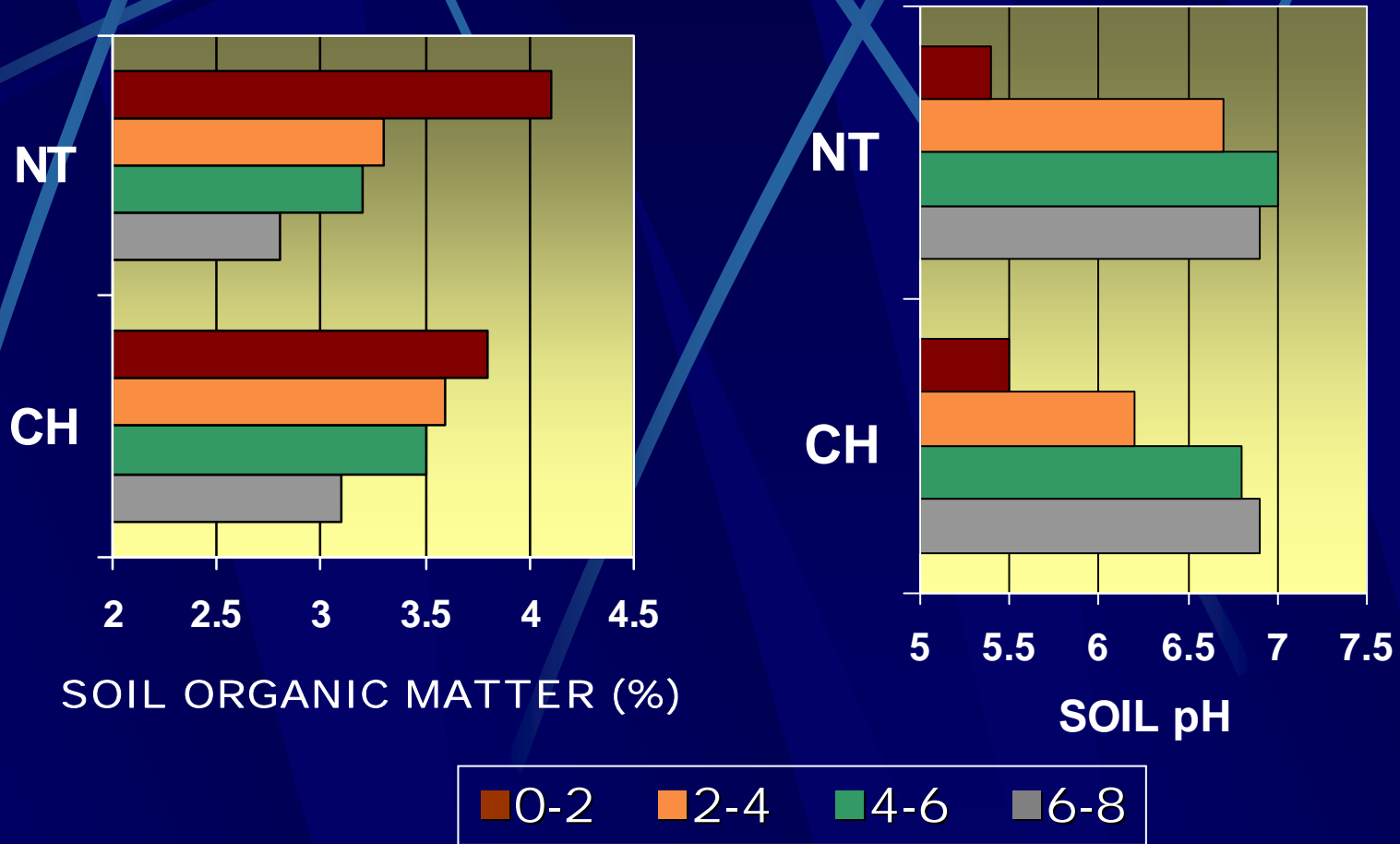
# Incremental Soil Sampling Comparisons

- Arlington tillage x herbicide study.  
No-till, chisel, moldboard for 20+ years.
  - Continuous corn
  - Recommended NPK fertilization, no lime
- Arlington production alfalfa field
  - NT Corn in 2003, seeded in 2004, two hay years
  - Light manure application
  - Previous chisel tillage history
- Both Plano silt loam (subsoil group B)

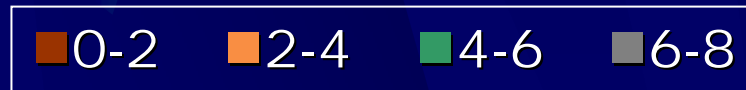
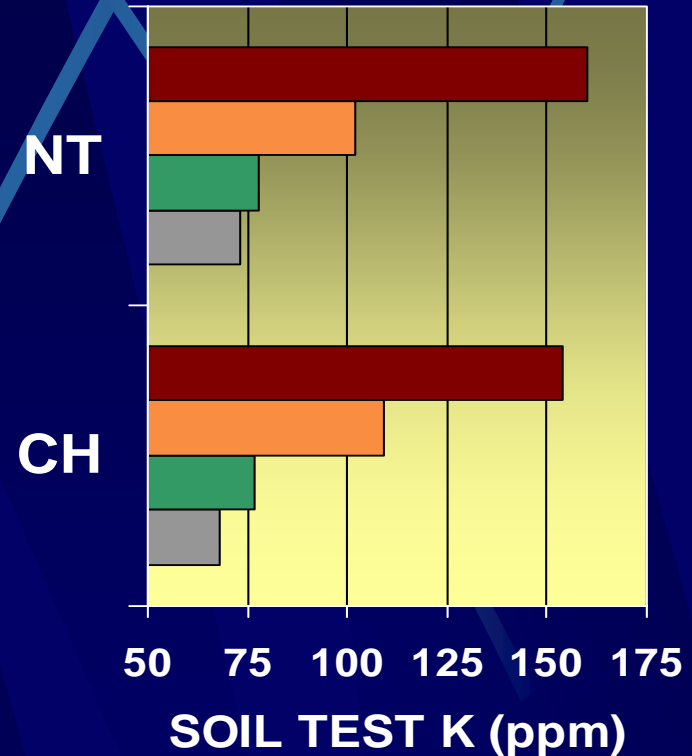
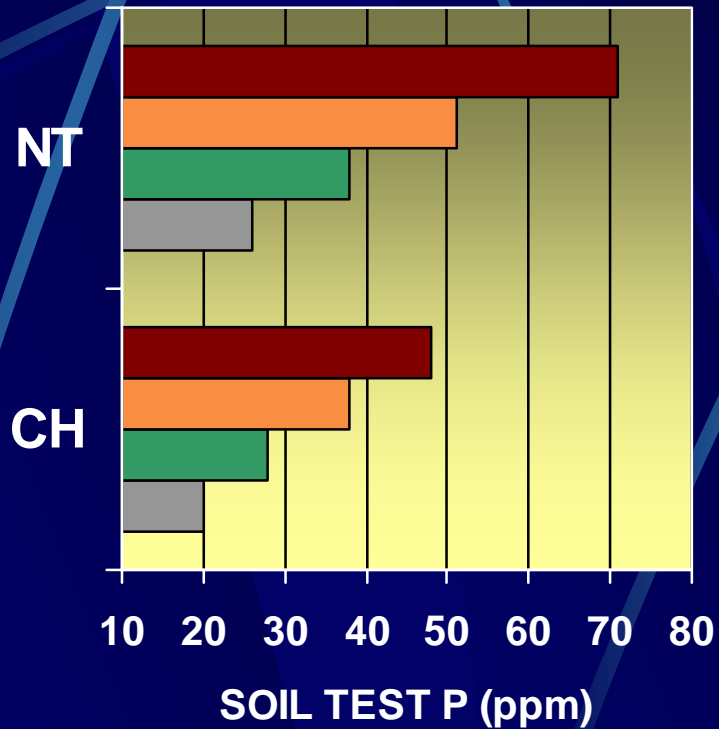
# Tillage and Soil Test Stratification

- Acidification due to nitrification of surface-applied ammonium containing fertilizer; OM accumulation in no-till
  - Would lead to higher lime rec. in surface
  - Possible consequences on herbicide activity and nutrient availability
- P and K stratification
  - Surface application with little or no incorporation
  - Leaching from crop residue
  - Incomplete mixing by conservation tillage

# Soil Test Stratification as Affected by Tillage Management, Arlington, Wis., 2005



# Soil Test Stratification as Affected by Tillage Management, Arlington, Wis., 2005



# Effect of Sampling Depth on Soil pH and Organic Matter

Depth	SOIL TEST			
	pH		OM (%)	
	CH	NT	CH	NT
0-4	5.9	6.1	3.7	3.7
0-6	6.2	6.4	3.6	3.5
0-8	6.4	6.5	3.5	3.3



# Effect of Sampling Depth on the Estimated Lime Requirement

LIME REQUIREMENT t/a 60-69 ( target pH = 6.8)		
Depth	Chisel	No-Till
0-4	5.3	4.1
0-6	3.4	2.3
0-8	2.2	1.7

# Effect of Sampling Depth on Soil Test P and K

Depth	Soil Test P		Soil Test K	
	----- ppm -----			
in	CH	NT	CH	NT
0-4	43 EH	61 EH	132 H	131 H
0-6	36 EH	53 EH	113 H	113 H
0-8	32 EH	47 EH	102 O	103 O

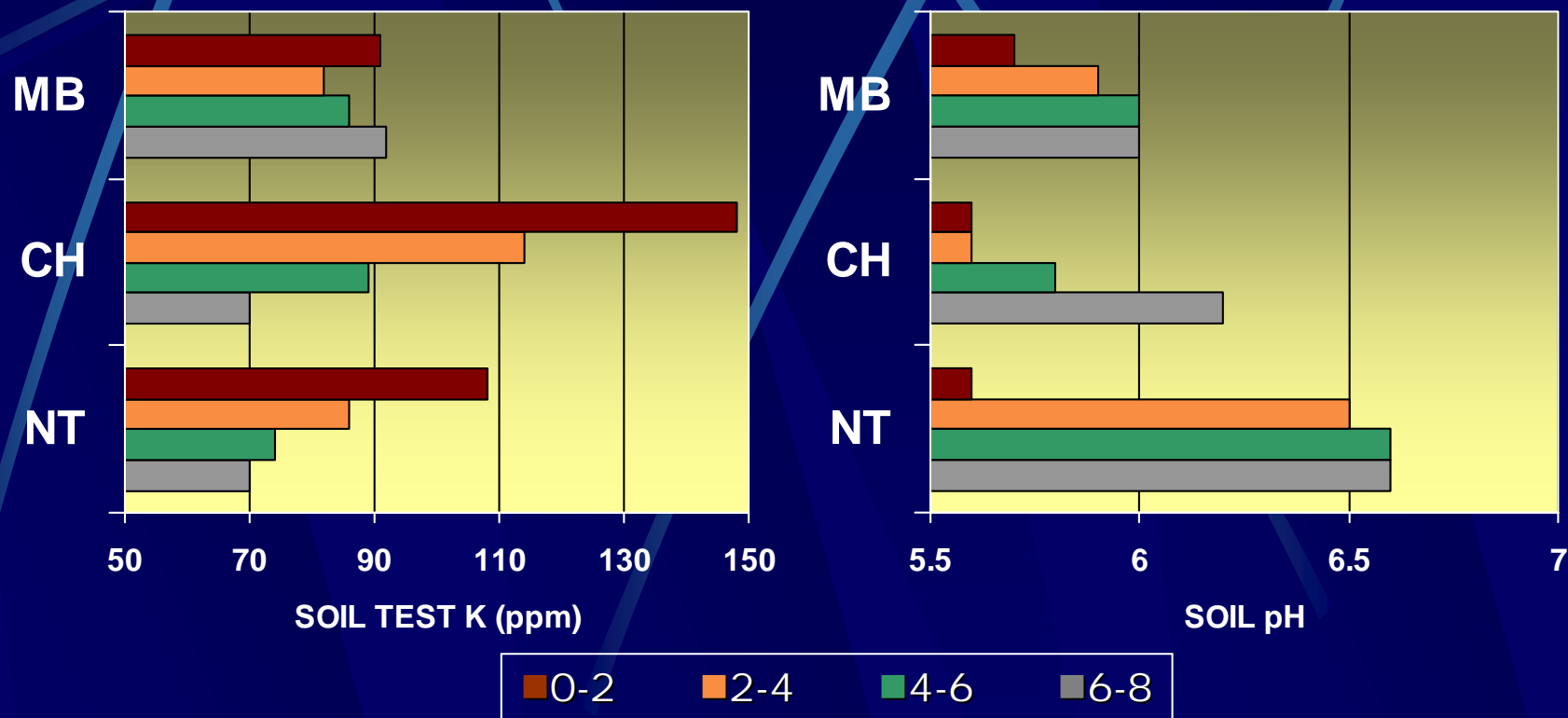
# Effect of Sampling Depth on P and K Recommendations for Corn

Depth	Soil Test P		Soil Test K	
	----- ppm -----			
in	CH	NT	CH	NT
0-4	0	0	25	25
0-6	0	0	25	25
0-8	0	0	55	55

# Effect of Sampling Depth on P and K Recommendations for Alfalfa

Depth	Soil Test P		Soil Test K	
	----- ppm -----			
in	CH	NT	CH	NT
0-4	0	0	150	150
0-6	0	0	300	300
0-8	0	0	300	300

# Soil Test Stratification Following 20 Years Of Tillage Management, Arlington, Wis., 2006



# Effect of Sampling Depth Soil pH

Depth	Soil pH		
	MB	CH	NT
in			
0-4	5.8	5.6	6.1
0-6	5.9	5.7	6.2
0-8	5.9	5.8	6.3

*Tillage in place 20 years*



# Effect of Sampling Depth the Lime Recommendation for Corn and Alfalfa

	Corn			Alfalfa		
Tillage	Sampling depth (in)			Sampling depth (in)		
	0-4	0-6	0-8	0-4	0-6	0-8
	----- ton 60-69/a -----					
MB	1.2	0.4	0.6	5.9	5.3	5.5
CH	2.7	2.0	1.2	8.1	7.2	6.2
NT	0	0	0	4.7	3.7	3.0

# Effect of Sampling Depth Soil Test K

Depth	Soil Test K		
in	MB	CH	NT
	----- ppm -----		
0-4	87 L	131 H	97 O
0-6	87 L	117 H	89 L
0-8	88 L	105 O	85 L

*Tillage in place 20 years*

## Effect of Sampling Depth the Potash Recommendation for Corn and Alfalfa

	Corn			Alfalfa		
Tillage	Sampling depth (in)			Sampling depth (in)		
	0-4	0-6	0-8	0-4	0-6	0-8
	----- lb K <sub>2</sub> O/a -----					
MB	80	80	80	330	330	330
CH	20	20	20	150	150	300
NT	50	80	80	300	330	330

## Effect of Sampling Depth Soil Test K in a Production Alfalfa Field

Depth Increment	Soil Test (ppm)		Sample Depth	Soil Test (ppm)	
	P	K		P	K
0-2	20	265	0-4	16	208
2-4	12	150	0-6	14	171
4-6	11	99	0-8	14	151
6-8	11	90			

*510 lb K<sub>2</sub>O/a since 2004*

# Summary

- Farmer profitability and regulatory compliance depends on proper soil sampling and testing
- Maintain management of surface variability, but attention must also be paid to depth variability
- Stratification and how it effects fertilizer or lime recommendations emphasizes the need to sample to proper depth
  - Too shallow = excessive recommendation
  - Too deep = inadequate recommendation
- Chisel tillage does not remove stratification
- Best advice is to sample to depth of the dominant tillage and maintain consistency