

# ***P & K Movement in Soil?***

## ***2016 Demo Project***

- 2015 - P & K Fertilizer applied
- 4 Sites in MN, ND and MB
- Fertilizer rates applied ( $P_2O_5$  and  $K_2O$  lb/a)
  - 50/50
  - 100/100
  - 200/200
  - 0/1000

# ***P & K Movement in the soil?***

- What happens to P & K fertilizer when it hits the soil?
- Does soil pH effect movement?
- Does soil texture effect movement?
- Does high rainfall or irrigation affect movement?



# ***Locations***

- Hillsboro, ND - Sarah Lovas
- Rose Isle, MB - John Heard
- Benson, MN - Richard Jenny
- Northwood, ND – John Lee











# ***P & K Applied and Incorporated (Northwood site)***



# ***Phosphorus Movement in “Soil Profile”***

- Phosphorus Fertilizer
  - Acid soil (pH < 7.0) – P precipitates with aluminum and iron to form compounds that have **low solubility**
  - Alkaline soils (pH > 7.0) – P precipitates with calcium to form compounds that have **low solubility**
  - Very little P in soil solution – Not much P in soil solution to be leached away

# ***P Fertilizer Movement in Soil***

Treatment lb/a P <sub>2</sub> O <sub>5</sub>	Sample depth	*Sandy loam ppm pH 8.2	*Loam ppm pH 8.0	*Silty Clay Loam ppm pH 6.1	*Clay ppm pH 7.9
0	0-6"	4	4	42	14
	6-12"	 (2)	 (3)	 (3)	 (3)
50 lb/a	0-6"	8	6	54	16
	6-12"	(2)	(2)	(6)	(4)
100 lb/a	0-6"	8	7	54	22
	6-12"	(2)	(2)	(7)	(5)
200 lb/a	0-6"	15	18	88	28
	6-12"	 (3)	 (2)	 (6)	 (4)


\*Sandy Loam - Rose Isle MB, Loam - Northwood ND, Silty Clay Loam - Benson MN, Clay - Hillsboro ND,

# ***Phosphorus Results?***

- Very little P moved into 6-12" profile
- Even high "P" rates had little effect
- This shows how important sampling depth is!!!
- Sample Too deep = Lower P test!!!!



# ***Potassium Movement in Soil***

- Potassium is held to soil by positive charge ( $K^+$ )
- Soil particles have negative charge 
- Soil texture is a factor
  - Sandy soils with low cation exchange capacity (CEC) (not as many sites to hold  $K^+$ )
  - K fertilizer rate can exceed capacity of soil to hold  $K^+$  on very sandy soil
- Soil pH is not a factor



# ***K Fertilizer Movement in Soil***

Treatment lb/a K <sub>2</sub> O	Sample depth	*Sandy loam ppm	*Loam ppm	*Silty Clay Loam ppm	*Clay ppm
0	0-6"	100	200	320	460
	6-12"	40	150	140	370
50 lb/a	0-6"	60	220	290	480
	6-12"	45	160	140	390
100 lb/a	0-6"	140	240	320	510
	6-12"	35	160	155	370
200 lb/a	0-6"	90	280	430	520
	6-12"	40	150	160	390
1000 lb/a	0-6"	270	420	Na	740
	6-12"	45	200	Na	400

\*Sandy Loam - Rose Isle MB, Loam - Northwood ND, Silty Clay Loam - Benson MN, Clay - Hillsboro ND,

***K movement on “Irrigated Loamy Sand”  
U of Minnesota – Carl Rosen 2014-15***

Treatment K <sub>2</sub> O lb/a	Sample depth	K - ppm
Check	0-6	38
	6-12	25
	12-24	29
90 lb/a	0-6	50
	6-12	27
	12-24	32
180 lb/a	0-6	58
	6-12	28
	12-24	33

# ***K movement on “Irrigated Loamy Sand”***

## ***U of M – Rosen 2014-15***

Treatment K <sub>2</sub> O lb/a	Sample depth	K - ppm
270 lb/a	0-6	78
	6-12	25
	12-24	37
360 lb/a	0-6	113
	6-12	33
	12-24	69
180 + 180 lb/a <sup>1</sup>	0-6	81
	6-12	30
	12-24	39

# ***Potassium Results?***

- Very little K moved into 6-12" profile
- Even high rates had little effect
- K can move in Irrigated Sandy Soils with very high rates
- Sampling depth important for K too!



# Questions??





## ***P & K Treatment Affect on Tissue levels (Northwood Location)***

<b>Treatment lb/a P<sub>2</sub>O<sub>5</sub> &amp; K<sub>2</sub>O</b>	<b>*%P Concentration in Plant Tissue</b>	<b>*%K Concentration In Plant tissue</b>
<b>Check</b>	<b>0.15</b>	<b>1.5</b>
<b>50 /50</b>	<b>0.18</b>	<b>1.8</b>
<b>100/100</b>	<b>0.21</b>	<b>1.6</b>
<b>200/200</b>	<b>0.29</b>	<b>1.9</b>
<b>Uffda TRT - 0/1000</b>	<b>0.13</b>	<b>1.7</b>

\*P sufficiency range is .30 - .50%, K sufficiency range is 2.0-3.0%

P soil test is 3 ppm Olsen, K soil test is 150-200 ppm