



Practical Systems Approach to Efficient P & K Management

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P and K Management in Conservation Tillage

- Requires a higher level of attention than conventional tillage systems
 - Different approach to soil sampling
 - Different approach to P and K placement
 - Possibly different equipment for application



Characteristics of P in the soil

- Phosphorus uptake is influenced by:
 - Immobility
 - P will not readily move in the soil like nitrogen
 - Binding with calcium, iron, and aluminum compounds
 - most P does not dissolve in soil solution
 - P adheres to varying degrees with soil compounds



Characteristics of P in the soil

- The interaction between the soil and phosphorus makes placement and application method very important
 - Especially in low pH and high pH environments



Characteristics of K in soil

- Potassium uptake is influenced by:
 - Immobility
 - K is an immobile nutrient
 - Soil moisture
 - low soil moisture generally reduces the availability of K
 - increasing soil moisture increases K availability and uptake
 - Oxygen in the root area
 - root activity and K uptake decrease as soil moisture surpasses field capacity



Characteristics of K in soil

- Potassium uptake is influenced by:
 - Clay content of the soil
 - K can be trapped between layers of clay
 - Tillage system
 - no till / conservation tillage (CT) systems can have lower K levels available to the plants possibly due to slower root growth and restricted distribution of roots in the soil



Impact of P & K characteristics in the field

- **Stratification of P and K in the soil profile**
 - **Horizontal stratification**
 - broadcast applications
 - little or no incorporation of residue
 - **Vertical stratification**
 - repeated banded applications



Soil sampling in conservation tillage

- Soil sampling is the first step to managing P and K in any tillage system
- Test the soil for pH, Organic Matter, P, K and Zn



Soil Sampling in conservation tillage

- **Complications to obtaining an accurate and representative sample in CT**
 - Nutrient stratification
 - with broadcast applications in CT, pH tends to be lower in the top 3 inches of the soil and increases with depth
 - sampling depth is important (use 0-3” depth for pH and 0-6” depth for P, K, and Zn) in CT systems



Soil Sampling in conservation tillage

- **Complications to obtaining an accurate and representative sample in CT (cont.)**
 - **Application practices**
 - banded applications (fixed band location vs. unknown location of band)



Soil Sampling in conservation tillage

- **Soil sampling tips to increase sample accuracy**
 - Know where to insert the probe in the ground
 - broadcast fertilizer system
 - 15 to 20 cores per sample from in between the rows



Soil Sampling in conservation tillage

- **Soil sampling tips to increase sample accuracy (cont.)**
 - Know where to insert the probe in the ground
 - banded fertilizer system with known location of band
 - 15 to 20 cores per sample; six inches from the center of the band for fixed location bands (ex: ridge-till)
 - 30 to 40 cores per sample with 1 in 20 cores taken from the band and the other 19 from in between the bands (for 30" rows)



Soil Sampling in conservation tillage

- **Soil sampling tips to increase sample accuracy (cont.)**
 - Know where to insert the probe in the ground
 - banded fertilizer system with the location of the band unknown
 - take a pair of cores at each location with 15 to 20 locations
 - the first core is taken at random and the second core of the pair is taken at 50% of the band spacing from the first core and perpendicular to the band direction



Soil Sampling in conservation tillage

- Use technology to aid sampling and application accuracy
 - GPS helps sampler to take samples in the same locations
 - Auto-steer can help keep the band in the same location year after year
 - Grid and Zone sampling can provide variable rate application opportunities



P & K placement in conservation tillage

- **Broadcast P and K**
 - Soybeans are more responsive to broadcast applications of P and K
 - Can work for deep rooted crops (ex: corn) if:
 - the field has a high to very high soil test
 - there is an even mat of adequate residue to keep the upper soil profile moist and decrease the soil temperature



P & K placement in conservation tillage

- Broadcast P and K
 - Overtime broadcast applications with little or no tillage will cause horizontal stratification to occur
 - horizontal stratification can cause K deficiencies even high testing soils when dry conditions persist during the high nutrient demand times for corn of June and July



P & K placement in conservation tillage

- Banded P and K
 - Very efficient use of immobile nutrients for deep rooted crops (corn, wheat, etc.)
 - less soil is in contact with the fertilizer
 - lower binding of nutrients to the soil
 - more nutrients in the band are available for plant uptake
 - can cut the application rates by 1/3 to 1/2 of broadcast recommendations



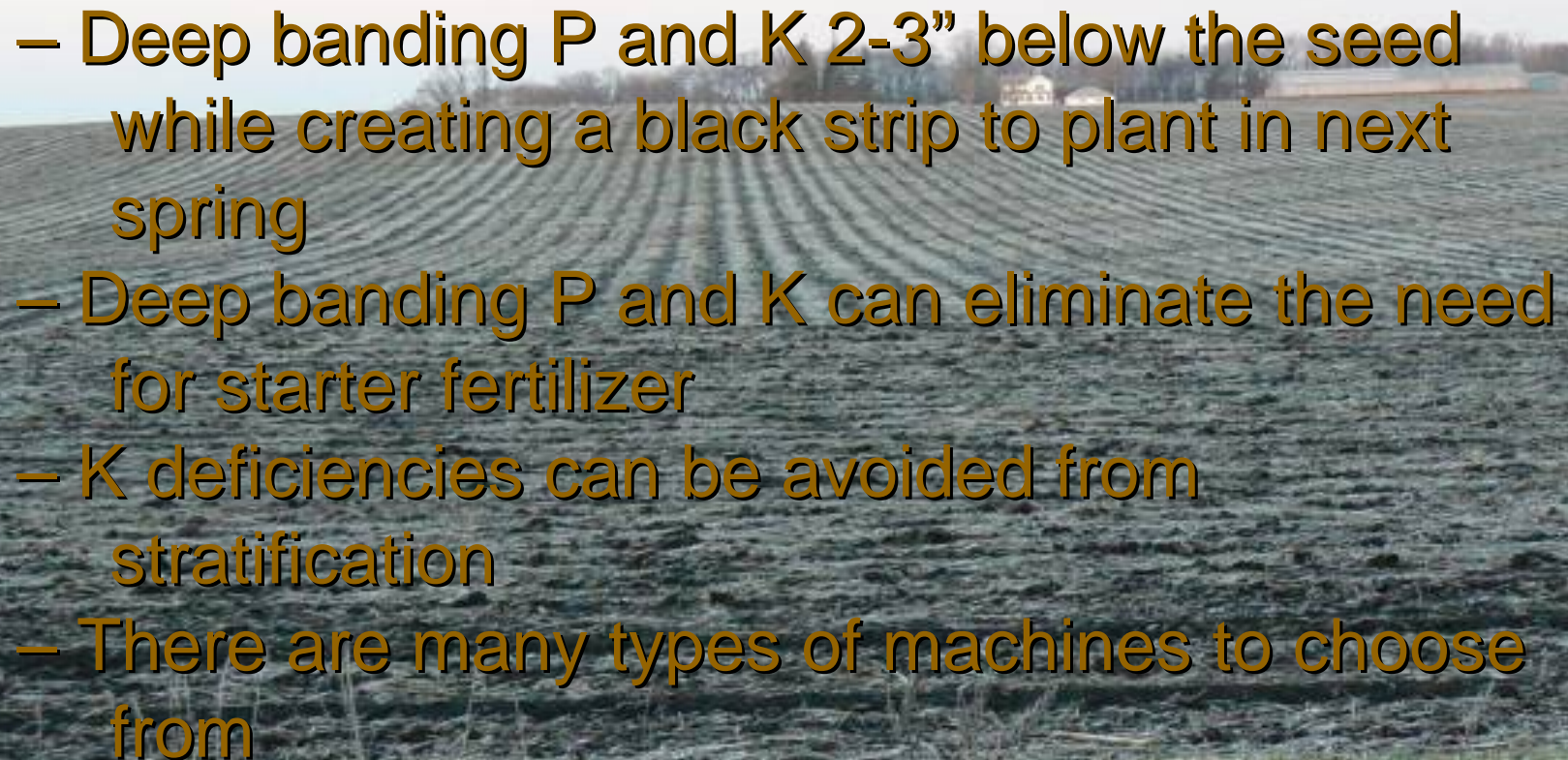
P & K placement in conservation tillage

- Banded P and K
 - Deep banding K can prevent K deficiencies in corn and increase yields even on high testing soils
 - Deep banding P provides similar results to starter P applications such as increased early growth, but does not provide a consistent yield return over broadcast



P & K placement in conservation tillage

- **Strip-till**

- Deep banding P and K 2-3” below the seed while creating a black strip to plant in next spring
 - Deep banding P and K can eliminate the need for starter fertilizer
 - K deficiencies can be avoided from stratification
 - There are many types of machines to choose from
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P & K placement in conservation tillage

- Strip-till machine types:





P & K placement in conservation tillage

- **Deep Bander/Injector**
 - Deep banding P and K with little or no movement of crop residue
 - Used in no-till and ridge-till systems
 - K deficiencies can be avoided from stratification



P & K placement in conservation tillage

- Planter starter
 - Shallow banding of P and K
 - Especially useful for applying P
 - Starter with K shows more benefit in CT systems than in conventional tillage systems
 - Beneficial to early plant growth in a colder and wetter environment that CT leaves us with in the spring

P & K placement in conservation tillage

- Planter starter





P & K placement in conservation tillage

- Planter starter placement
 - 2x2” placement; good for high rate N starters, higher rates of K, and sulfur
 - 2x0” placement; good for high rate N starters, higher rates of K, and sulfur
 - Pop up starter on seed; good for P and Zn placement, but risky for N, K and sulfur applications



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