Preferred K Placement Choices for Corn and Soybean in Conservation Tillage Systems?

Tony J. Vyn, Ann Kline, Scott McCoy, Brian Ball and Ignacio Conti
Strip Tillage with Fertilizer Banding
Strip Tillage for Corn in N. Indiana, Loam (2001-03)

![Bar chart showing yield comparison for Soybean and Corn with previous crops.](chart.png)

- **Soybean**
  - Fall Chisel: 193
  - Strip-till: 196
  - No-till: 192

- **Corn**
  - Fall Chisel: 180
  - Strip-till: 177
  - No-till: 169

Legend:
- Light blue: Fall Chisel
- Green: Strip-till
- Purple: No-till

Notes:
- Single letter codes (a, b) indicate significantly different treatments at the 10% level.
Planting Date Effects in 2003

- Early
- Optimum?
- Early
- Optimum?

- W. Lafayette
- Pinney-PAC

Strip-Till
No-Till
Chisel

Narrow row production started.
Population densities of Soybean Cyst Nematode under different crop sequences and tillage

(Westphal and Vyn)
Potassium Stratification
Long-Term Tillage (IN, 1975-94)

Source: Holanda et al. (1998)
Conservation Tillage Doesn’t Alter K distribution appreciably
1. Does K placement Matter?
2. Implications for Management?
## Corn Yield Response to Deep Banding in Indiana* (1984-1985)

<table>
<thead>
<tr>
<th>Fertilizer Rate</th>
<th>Placement</th>
<th>No Starter</th>
<th>Starter</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-25-50</td>
<td>Broadcast</td>
<td>144</td>
<td>154</td>
</tr>
<tr>
<td></td>
<td>Band 5”</td>
<td>151</td>
<td>154</td>
</tr>
<tr>
<td>30-50-100</td>
<td>Broadcast</td>
<td>159</td>
<td>156</td>
</tr>
<tr>
<td></td>
<td>Band 5”</td>
<td>159</td>
<td>160</td>
</tr>
</tbody>
</table>

* Source: Mengel et al. 1998
RESPONSE OF CORN TO ROW-APPLIED K ON A SILTY CLAY LOAM SOIL (3 yr. avg.)

Dr. Wolkowski, UW, Oshkosh, Wis. (45 lb K₂O/a)
Mean Soil-test K Stratification at Davis-PAC

Source: Vyn et al., Better Crops #4, 2002
Placement in presence of high soil K variability?
High oil corn yields in response to K placement (Davis-PAC 2000-01)

Source: Vyn et al., Better Crops #4, 2002
No-till Soybean Height Differences at Davis PAC in 2003

Impact of K Banding Depth in Corn?
High Yield Corn Response to Placement

Hybrids: 1. Pioneer 34B24
         2. Pioneer 34M95

Populations: 1. 32,000
             2. 42,000

P&K Fertilizer Placements: 1. Control
                           2. Broadcast
                           3. Shallow Band (6”)
                           4. Deep Band (12”)
                           5. Shallow + Deep (6 and 12”)

Sponsor: PPI-FAR 2001-2003
Placement Effects on Leaf K %
Pion. 34M95 in 2003

![Bar graph showing the effect of different placement methods on leaf K% at different plant densities. The methods include control, broadcast, band 6", band 12", and band 6" & 12".]
Yield Evaluation
Yield Responses to Placement in 2001-2002

P & K Placement Effects on Yield
(mean of 2 hybrids and 2 populations)
Corn Yield Response of Pion. 34M95 to Alternate P plus K Placements in 2003

![Bar chart showing corn yield response to different P and K placements and plant densities.](chart.png)

- **Control**
- **Broadcast**
- **6” Band**
- **12” Band**
- **6” plus 12”**

**Corn Yield (bu/acre)**

- **32,000 ppa**
  - Control: 180
  - Broadcast: 190
  - 6” Band: 200
  - 12” Band: 210
  - 6” plus 12”: 220

- **42,000 ppa**
  - Control: 190
  - Broadcast: 200
  - 6” Band: 210
  - 12” Band: 220
  - 6” plus 12”: 230
Consistency of Resource Availability in High Population Environments?
6-7” Placement Effects on Corn Yield in 2003

- Control
- Broad. P & K
- Band P & K
- Band P
- Band K

Bar chart showing the yield comparison between different treatments for Pion. 34M95 and Pion. 31N28.
Soybean Response to K Placement
Aerial accumulation of N, P, and K by soybean (80 bu/A)

Soybean Yield Responses to K fertilization and Placement in No-Till in Iowa (1994 to 1997)

<table>
<thead>
<tr>
<th>Trial Type</th>
<th>Site-Years</th>
<th>Initial Soil K</th>
<th>K Fertilizer Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long-term</td>
<td>20</td>
<td>115 to 262</td>
<td>29 &amp; 59</td>
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<tr>
<td>Short-term</td>
<td>11</td>
<td>90 to 258</td>
<td>29 &amp; 118</td>
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</tbody>
</table>

No-till Soybean Yield Responses to K fertilization and Placement in No-Till in Iowa (Cont.)
Average of 1994 to 1997

<table>
<thead>
<tr>
<th>Trial Type</th>
<th>Treatment</th>
<th>Statistics</th>
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<tbody>
<tr>
<td>Zero K</td>
<td>Broad- cast K</td>
<td>Fert</td>
</tr>
<tr>
<td>Zero Deep- K</td>
<td>Deep- band K</td>
<td>Place</td>
</tr>
<tr>
<td>Zero Starter- K</td>
<td>Starter- band K</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Fert</th>
<th>Place</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long-term</td>
<td>0.01</td>
<td>0.10</td>
</tr>
<tr>
<td>Short-term</td>
<td>0.01</td>
<td>0.22</td>
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</tbody>
</table>

Borges & Mallarino, 2000
Comparison of no-till with zone-till and fall disk systems

No-till
- Narrow row (15”)
- Fall broadcast
  (no incorporation)

Zone-till
- Wide row (30”)
- Fall band
  (6” deep)

Fall disk
- Narrow row (15”)
- Fall broadcast
  (incorporation)

Yin and Vyn, Agron. J., 2002
Growth of Vegetative and Reproductive Tissue

Impedance to Root Growth

Oxygen Availability

Herbicide Injury

Disease

Temperature Stress

Water + Nutrient Stress

Respiration

Potential Daily Growth
Trifoliate Leaf K at R1?

\[ Y = 55.7 + 3.1X - 0.06X^2 \]

\[ P < 0.05 \quad R^2 = 0.33 \]

Source: Yin and Vyn, 2003
Leaf K Concentrations and Soybean Seed Composition

Yin and Vyn, 2002
Narrow-Row Soybeans Following Corn with Alternate K Placement

1. Extent of vertical and horizontal soil exchangeable K distribution
2. Actual soybean row widths
3. Environment and genetic impacts on root system distribution
USB-FAR Projects in 2003

Split-split plot Treatments:

Prior Corn Hybrids (2)

Prior Fertility:
1. Control
2. Broadcast P and K
3. Band P and K (6”)
4. Band P alone
5. Band K alone

Potassium in 2003:
1. None
2. Broadcast
Row position effects on Exch. K ppm
High Yield Corn Plots, 2002
Row Position Effects on Soil Exc. K at 2 Depths (0-4” and 4-8”)

- **Mid 0-4”**: Control, Surface, Band 6", Band 12", Band 6 + 12"
- **Row 0-4”**: Control, Surface, Band 6", Band 12", Band 6 + 12"
- **Mid 4-8”**: Control, Surface, Band 6", Band 12", Band 6 + 12"
- **Row 4-8”**: Control, Surface, Band 6", Band 12", Band 6 + 12"
Strip Tillage with Fertilizer Banding?
Conclusions

1. Banding of K has possible advantages in stratified soils, dry summers, and in high yield situations.

2. Banded K may be more beneficial with certain corn hybrids and environments (high populations).

3. Banded K for corn may be detrimental to narrow row soybean in lower K soils.

4. More research required on rates, mixtures, and impact on no-till soybean.
Thanks!

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Case

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