Yield of Corn and Soybean Managed with Tillage or No Tillage as Affected by the Phosphorus and Potassium Placement Method

Antonio Mallarino  
*Iowa State University*, apmallar@iastate.edu

John Jones  
*Iowa State University*, jdjones@iastate.edu

Jackson Hirniak  
*Iowa State University*, jhirniak@iastate.edu

Louis Thompson  
*Iowa State University*, louisth@iastate.edu

Daniel Schaben  
*Iowa State University*

*See next page for additional authors*

Follow this and additional works at: https://lib.dr.iastate.edu/farmprogressreports

Part of the Agricultural Science Commons, Agriculture Commons, and the Agronomy and Crop Sciences Commons

Recommended Citation

Mallarino, Antonio; Jones, John; Hirniak, Jackson; Thompson, Louis; Schaben, Daniel; and Beckman, John (2018) "Yield of Corn and Soybean Managed with Tillage or No Tillage as Affected by the Phosphorus and Potassium Placement Method," *Farm Progress Reports*: Vol. 2017 : Iss. 1 , Article 17.

DOI: https://doi.org/10.31274/farmprogressreports-180814-1922

Available at: https://lib.dr.iastate.edu/farmprogressreports/vol2017/iss1/17

This Armstrong Research and Demonstration Farm is brought to you for free and open access by the Extension and Experiment Station Publications at Iowa State University Digital Repository. It has been accepted for inclusion in Farm Progress Reports by an authorized editor of Iowa State University Digital Repository. For more information, please contact digirep@iastate.edu.
Yield of Corn and Soybean Managed with Tillage or No Tillage as Affected by the Phosphorus and Potassium Placement Method

Authors
Antonio Mallarino, John Jones, Jackson Hirniak, Louis Thompson, Daniel Schaben, and John Beckman
Yield of Corn and Soybean Managed with Tillage or No Tillage as Affected by the Phosphorus and Potassium Placement Method

RFR-A1793
Antonio Mallarino, professor
John Jones and Jackson Hirniak, graduate research assistants
Louis Thompson, ag specialist
Department of Agronomy
Daniel Schaben and John Beckman, ag specialists

Introduction
No-till management limits the incorporation of crop residue and fertilizer with soil, which results in wetter and colder soils in early spring and accumulation of organic matter, phosphorus (P) and potassium (K) near the soil surface. Subsurface banding of P and K could be more effective than broadcast fertilization by applying nutrients below the soil surface. Therefore, a long-term study was established in 1994 to evaluate P and K rates and placement methods for corn and soybean managed with no-till and chisel-plow/disk tillage. The study evaluated broadcast, planter-bands, and deep bands until 2001 when the deep-band treatment was discontinued. This report summarizes results since 2002.

Materials and Methods
Separate P and K trials were established in 1994 on areas with Marshall soil series. Corn and soybean were planted using a 30-in. row spacing on adjacent areas with identical treatments and the crops alternated sides each year to complete a rotation. Plots with cornstalks were chisel-plowed in the fall, and plots with cornstalks or soybean residue were disked in the spring. Since 2002, the P and K placement methods have been broadcast and banded using granulated triple superphosphate (0-46-0) and potassium chloride (potash, 0-0-62) fertilizers. The broadcast treatments were applied in the fall and bands were placed 2 in. below and 2 in. beside the seeds with planter attachments. Other than a non-fertilized control for each nutrient, annual applications with both placement methods are one-half the estimated maintenance rate (28 lb P₂O₅/acre or 35 lb K₂O/acre) and the full rate (56 lb P₂O₅/acre or 70 lb K₂O/acre). Other broadcast application rates were twice the maintenance rates applied once for either crop or annually for both crops.

Results and Discussion
Tillage effects. Soybean grain yield has not been affected by tillage. Corn yield often has been higher with tillage than with no-till in normal or wet years, but often has been higher with no-till in droughty years. Therefore, long-term averages show very small tillage differences for corn. Corn yield differences between the tillage treatments since 2002 were three bushels/acre or less (Tables 1 and 2).

Phosphorus effects. Initial soil P in 1994 for the P trial areas was in the Optimum interpretation category, and values for the control plots decreased to Low in 2003 and to Very Low in 2010. Therefore, the yield response to P has increased over time. Table 1 shows the broadcast 56-lb rate applied annually or 112-lb applied every year has maximized crop yield. Yield responses were 12 to 19 bushels/acre for corn and 3 to 6 bushels/acre for soybean. Yield with banded P has not been significantly different from yield with broadcast P. The corn yield averages since 2002 show the difference between the non-fertilized and fertilized treatments was greater with no-till than with tillage.

Potassium effects. Initial soil K in 1994 was in the High interpretation category. Values of the
control plots decreased to a value between Optimum and High by 2002, and there was no crop response to K until then. However, Table 2 shows small corn yield increases (5 to 9 bu/acre) were observed since 2002 with both tillage systems (but not for soybean). The K fertilizer placement methods did not differ for any crop or tillage system until 2015. Results for corn during the last two years are puzzling, however, because the high band K decreased yield with tillage but not with no-till.

Conclusions

The tillage system has not affected soybean yield. Corn yield has been higher with tillage in some years and higher with no-till in others, so the long-term averages showed no differences. Yield responses to P and K began increasing in recent years when soil-test values of non-fertilized plots decreased into the Optimum or lower interpretation categories. The long-term averages showed no differences between broadcast and planter-banded P or K placement methods for any crop or tillage system.

Acknowledgements

Financial support from International Plant Nutrition Institute and Potash Corp., and seed donation from Monsanto.

Table 1. Phosphorus placement and application rate effects on crop yield.

| Period | Tillage | Control | Placement method and rate (lb P₂O₅/acre) | | |   |   |   |   |
|--------|---------|---------|-------------------------------------------|---|---|---|---|
|        |         |         | Broadcast                                   | Planter band | | |   | |
|        |         |         | 28  | 56  | 56b | 112 | 28 | 56 | |
| 2002-17| Chisel-disk | 185 | 194 | 196 | 198 | 198 | 192 | 194 | |
|        | No-till | 181 | 193 | 196 | 195 | 196 | 188 | 194 | |
| 2012-17| Chisel-disk | 232 | 246 | 251 | 251 | 249 | 238 | 246 | |
|        | No-till | 233 | 249 | 254 | 253 | 248 | 234 | 253 | |

56b = twice the annual 56 lb-rate applied once for the 2-year rotation.

Table 2. Potassium placement and application rate effects on crop yield.

| Period | Tillage | Control | Placement method and rate (lb K₂O/acre) | | |   | |   |   |   |   |
|--------|---------|---------|-----------------------------------------|---|---|---|---|
|        |         |         | Broadcast                                | Planter band | | |   |   | |
|        |         |         | 35 | 70 | 70b | 140 | 35 | 70 | |
| 2002-17| Chisel-disk | 189 | 192 | 195 | 195 | 195 | 192 | 191 | |
|        | No-till | 192 | 196 | 195 | 197 | 198 | 197 | 195 | |
| 2012-17| Chisel-disk | 228 | 245 | 240 | 238 | 231 | 231 | 223 | |
|        | No-till | 234 | 240 | 240 | 238 | 239 | 232 | 240 | |

70b = twice the annual 70-lb rate applied once for the 2-year rotation.