

TILLAGE EFFECTS ON SOIL NUTRIENT DISTRIBUTION

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INTERPRETIVE SUMMARY

Rationale: Because the surface soils of the Coastal Plain are easily compacted, some form of deep tillage is recommended to allow plant roots to explore more soil volume. For crops grown in row-widths of 30-in or more, most farmers use in-row subsoiling to loosen the soil directly under the row. Often, farmers return to the same row area with the subsequent crop to re-use old subsoil slits or to reduce the soil area compacted by tractors and equipment. We measured the horizontal and vertical distribution of soil P and K after 6 years of growing crops in 30-in rows with conservation tillage and controlled traffic. Wheat double-cropped with soybean was grown the first 3 years, corn was grown the second 3 years. Treatments were subsoiling annually and no deep tillage. To measure vertical distribution of nutrients, we separately sampled the surface 2-in, the rest of the A horizon, the entire E horizon, and the top 3-in of the B horizon. For a measurement of horizontal distribution, samples were collected from directly in the row and from random areas in the row middles. All P and K fertilizers were broadcast applied each year.

Results: As expected, highest concentrations of P occurred in the surface 2-in of the profile. Concentrations decreased with depth, and there was no measurable P in the top 3 inches of the B horizon.

Higher concentrations of P occurred in the row middles than directly in the row, both with and without subsoiling. This was probably because plant roots were more numerous in that region. Higher yields with subsoiling caused greater P removal in the seed, resulting in those plots having lower P levels than those that were not subsoiled. Potassium distribution was more uniform throughout the profile than was P distribution. The horizontal distribution of K was opposite than was found for P. In the surface soil, there were higher concentrations of K in the soil in the row than in the soil in the row middles. Averaged over both row locations, K levels in the surface 3 inches of the B horizon were lower in plots that were subsoiled than in the non-subsoiled plots. This suggests greater root concentration and more nutrient uptake from that horizon in the subsoiled plots.

Implications: Substantial vertical and horizontal distributions of P and K were found after 6 years of conservation tillage in this study. These data support current recommendations for collecting soil samples from conservation tillage fields. When soil sampling for fertilizer recommendations in long-term conservation tillage, care must be taken to collect samples from both in the rows and in the row middles.