Alternating Paratill Shank Placement for Enhanced Soil Disruption

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ABSTRACT

A Paratill™ is a type of bent-leg non-inversion tillage implement commonly used on Coastal Plain soils of the southeastern U.S. to break naturally occurring consolidated soil layers. Conservation tillage operations with a Paratill™ are usually conducted with the shanks placed in the same location year after year, disrupting the same volume of soil. Moving the location of the shanks on the toolbar so they are inverted from the previous year's location can potentially increase the volume of disrupted soil below ground. This can create more favorable conditions for soil water redistribution into the root zone, while increasing soil rooting volume. The objective was to study the alternating placement of Paratill™ shanks on crop productivity and below ground disruption. The experiment was established in a corn (Zea mays) –cotton (Gossypium hirsutum) rotation with both crops present each year. Tillage treatments were: 1) Shanks on Paratill™ with points facing inward (common practice), and 2) Alternating the orientation of the shank points every other year. No differences in corn yields have been observed with the alternating shank location treatment in the first two years, but cotton yields were 7 and 32% greater in 2005 and 2006, respectively. Soil penetration resistance data collected at the end of both seasons suggest that the alternating shank location treatment loosens a greater volume of soil.

OBJECTIVE

The objective of this on-going work is to determine if alternating the location of the shanks on a Paratill™ benefits crop productivity by enhancing below ground soil disruption.

MATERIALS AND METHODS

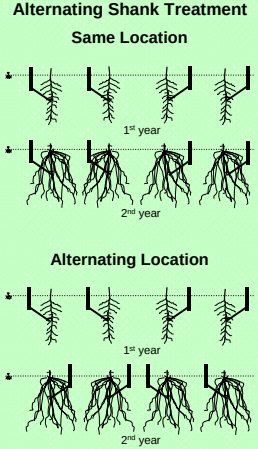
The study is being conducted at the Field Crops Unit of the E.V. Smith Research and Extension Center near Shorter, AL on a Compass loamy sand (coarse-loamy, siliceous, subactive, thermic Plinthic Paleudults). The experiment was established in Spring 2004, but due to the nature of the treatments, data collection did not start until the 2005 growing season. Two tillage treatments, same shank location and alternating every other year, are being studied. A corn-cotton rotation was established with both crops present each year.

Paratill™ implement with typical shank arrangement (points facing inward).

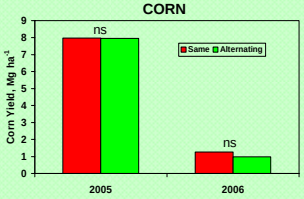
Front view of a single Paratill™ shank.

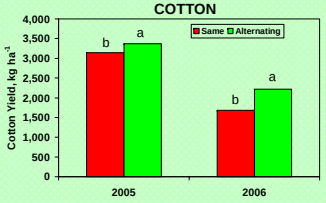
Multi-probe cone penetrometer

Cone index data were collected in the Fall with a multi-probe cone penetrometer consisting of five rods pushed into the ground simultaneously. The center rod was placed over the row, the outer two rods in the center of the row middles, and the remaining rods half way between the row and middles. Soil moisture data were collected using capacitance soil moisture probes inserted vertically in the row, at a depth of 5 cm from the surface, thus measuring from 5- to 25-cm of depth.



RESULTS AND DISCUSSION

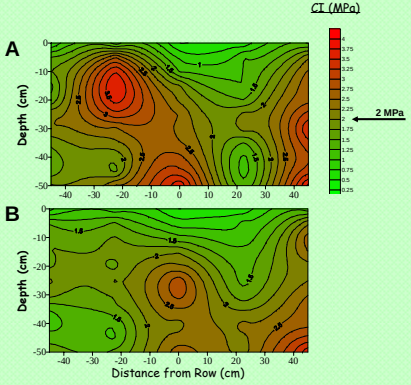


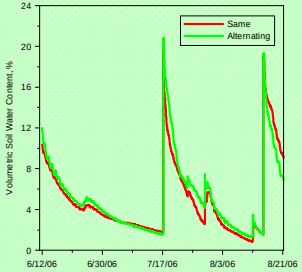


Corn yields were not affected by alternating the shank location in 2005 and 2006. However, alternating the location of the shank did increase seed cotton yields 7 and 32% for 2005 and 2006, respectively. Corn roots are probably less susceptible to soil compaction, whereas cotton plants tend to experience a condition called "J-rooting" when soil resistance is high. Overall yields for the 2006 season were suppressed due to a late season drought.

Typical "J-rooting" of a cotton plant. Notice how this particular root has changed rooting direction more than once.

Cone index values for 2006 tended to be lower in the rooting zone for the alternating shank placement (B) compared to when the shank location was the same year-after-year (A). Cone index values greater than 2 MPa can impair root development (see arrow on scale). The 0-cm value on the x-axis of the contour plots represents the row.





Soil water content was slightly greater for the alternating shank treatment during most of the 2006 growing season in the cotton crop. Differences in soil moisture for corn during the same year were minimal (data not shown). Soil moisture could have been affected by reduced cotton root development, and thus reduced water uptake.

CONCLUSIONS

- Alternating the shank every other year on a Paratill™ provided "looser" soil conditions for cotton, increasing yields significantly.
- The "looser" soil conditions most likely enhanced cotton root growth.
- Alternating the shank location can have a significant impact on cotton productivity. Long term use of this practice can have a greater impact.

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