In-Row Subsoiling Promotes Improved Soil Condition

By Randy Raper & D. Wayne Reeves

Compacted soil and hardpans prevent proper root growth and plant development. particularly in drought-prone Southeastern Coastal Plains soils. Using a subsoiler to alleviate this compacted layer over the entire field can be expensive and can even promote more soil compaction when the loosened soil is run over by field machinery.

Another approach to Increase rooting depth is to use a" in-row subsoiler that only disrupts the hardpan immediately beneath the plant row. In-row subsoiling before planting has been proven to provide adequate rooting capability in Coastal Plains soils that are conducive to hardpan formation. Coupling the in-row subsoiling operation with 'normal' no-till farming creates a conservation tillage practice that reduces the tillage energy necessary to disrupt the hardpan and allows the surface residue to be maintained for conservation compliance.

In-row subsoiling was one of the primary topics of a" experiment Jointlyconducted by the USDA-Agricultural Research Service's National Soil Dynamics Laboratory and the Alabama Agricultural Experiment Station at Shorter. Ala. This experiment evaluated the effects of in-row subsoiling, intensive deep tillage to completely disrupt the subsoil, surface tillage, and equipment traffic in a cotton-wheat double-cropping system.

The tillage system used in the experiment were as follows:

(1) conventional tillage with no subsoiling (disk, field cultivate and plant).

(2) conventional tillage with an initial one-time only complete hardpan disruption (disk. field cultivate and plant).

(3) conventional tillage with in-row subsoiling (disk. field cultivate. h-row subsoil and plant),

(4) no surface tillage with In-row subsoiling (in-row subsoil and plant).

A V-frame subsoiler on 9.8 inch centers and operating to a 19.7 inch depth was used to initially create the complete hardpan disruption operation for tillage treatment 2. The tillage practices were all conducted before cotton planting. All plots received the same tillage operations for the wheat production portion of the experiment, i.e., chiseling. disking, field cultivating and drilling.

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A special research tool, the Wide-Frame Tractive Vehicle (WFTV) was used to eliminate wheel traffic from all the plots in the test. The WFTV spans a 20-ft. width and was used to carry all tillage and harvesting implements and conduct all tillage operations in the 8-row plot areas. The WFTV was used on all of the plots so that the effect of traffic and its interaction with the tillage treatments could be analyzed. On half of the plots that were designated to receive traffic. a normal tractor was then operated in the proper row locations to simulate the traffic that would have been caused by the field operation.

At the end of a 5-year experiment using these tillage practices in the same plots every year, intensive soil sampling was conducted to determine the effect of these practices on the resulting soil conditions. A device that resembles a sharp stick, a soil cone penetrometer, was used to probe in each of the plots 800 times.

The force necessary to push the penetrometer into the soil was electronically recorded at every l/8 tn. of depth from the surface all the way down to a depth of 28 Inches. This force was then divided by the cross-sectional area of the probe to calculate the cone index. This value is an indication of the soil strength that the probe encounters as it is pushed into the soil.

The cone index values allowed a cross-sectional view of soil strengths to be constructed of the entire growing zone area. These views are informative because they allow us to view the soil profile and determine the depth of the hardpan. The hardpan depth is especially important during times of water stress because roots are not able to penetrate to sufficient depths to obtain necessary moisture.

Cone Index measurements were taken across the plant row from the untrafficked middle to the trafficked middle in 7.5 inch increments. Additional measurements of soil bulk density and soil moisture content were also taken in the plantrow. and in row middles at two depths. One sample was taken near the soil surface and a deeper soil sample was taken in the hardpan.

As we examined the information gathered from the soil sampling, we quickly noted how traffic was extreme1y negative in some plot areas but not very important in others. The difference was In-row subsoiling. When ever the in-row subsoiling practice was used (as in both the conventional tillage and no surface tillage with in-row subsoiling tillage treatments), traffic did not greatly affect the hardpan depth beneath the row.

Although several applications of traffic were applied after the in-row subsoiling tillage treatment, particularly in the conventional tillage plot. the area immediately beneath the row did not compact. The reason for this seems to be the soil strength of the row middles. Because this area was not tilled, it was able to withstand the negative effects of traffic and keep the forces from being transmitted beneath the plant row.

All the plots that did not receive in-row subsoiling suffered from the effects of traffic. These were the conventional tillage with no subsoiling and the conventional tillage with complete disruption tillage treatments. These two treatments offered an interesting comparison because one was uniformly subsoiled over the entire plot before starting the experiment and the other never received any subsoiling treatments.

Surprisingly, when both of these treatments received traffic, they were almost alike. The effect of traffic on the row middles had caused a plot that was completely disrupted by a V-frame subsoiler only 5 years earlier to recompact into a soil condition almost exactly like a plot that had never been subsoiled.

Determining the best tillage practice for the Coastal Plains soils used in this study was not very difficult. The no surface tillage with in-row subsoil treatment had the deepest hardpan depth and the lowest bulk density values beneath the row. This tillage system also took the least amount of energy. and therefore the least fuel cost, to raise the highest yielding cotton crop. All of this was accomplished while maintaining surface cover.

Therefore, a farmer with Coastal Plains soil doesn't have to own a WFTV to benefit from the effects of controlled traffic. They just need to in-row subsoil before planting and then keep wheel, traffic off the row.

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