USE OF PRECISION AGRICULTURE TECHNOLOGY TO EVALUATE SOIL COMPACTION

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INTERPRETIVE SUMMARY

The alluvial sandy and silt loam soils of the Mississippi, Ouachita, and Red River Valley are very easily compacted. The compaction zone or hardpan will vary in depth depending upon the past history of tillage. However, the compacted zone usually begins 6 to 10 inches below the surface of the soil and may be 2 to 5 inches thick. This compacted zone restricts root growth, water penetration, and water retention, thus crop yields can be reduced

The compacted zone can be temporarily eliminated by subsoiling at depths of 12 to 15 inches. The subsoiler point should run 2 to 3 inches below the compacted zone. Research has shown that subsoiling to a greater depth will not increase yields. Research also indicates that it is best to subsoil in the fall when the soil is dry. This allows winter rains to infiltrate the soil and be retained to produce the following year's crop.

Producers often ask questions about how frequently a field should be subsoiled and if the entire field should be subsoiled. On-farm demonstrations indicate that producers who use a permanent row, controlled traffic system can maintain yields by subsoiling every second or third year. However, producers indicate they need a method of evaluating compaction problems to assist in making decisions concerning when to subsoil.

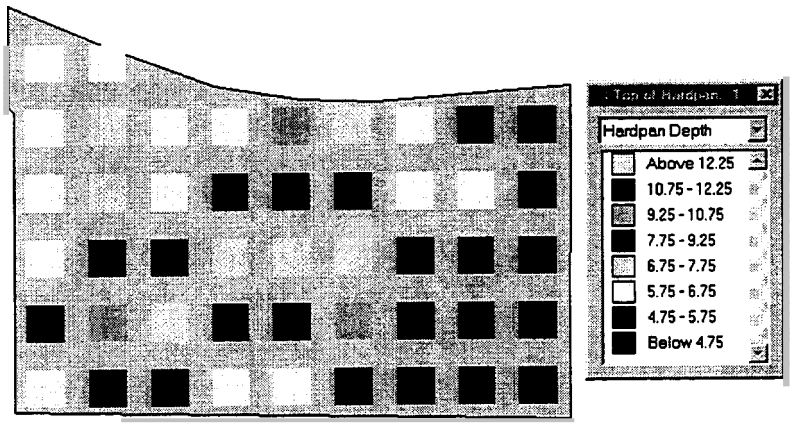
On-farm demonstrations indicate that the depth and density of compacted zones vary considerably in large fields. To obtain a better understanding of soil compaction, Extension specialists and county agents used a GPS with differential correction and a Dickey-John soil compaction tester to evaluate hardpan depth in several northeast Louisiana fields. Grid size varied from 1.0 to 2.5 acres.

To evaluate soil compaction in a cooperating producer's field, the GPS was used to locate the center of the grid. Compaction was evaluated by measuring the distance from the soil surface to the point where the resistance to penetration exceeded 300 PSI. The hardpan depth was measured in four places within a 15-ft radius of the center of the grid. The depth of the hardpan was recorded, and the average depth was used with mapping software to prepare color-coded maps of hardpan depth.

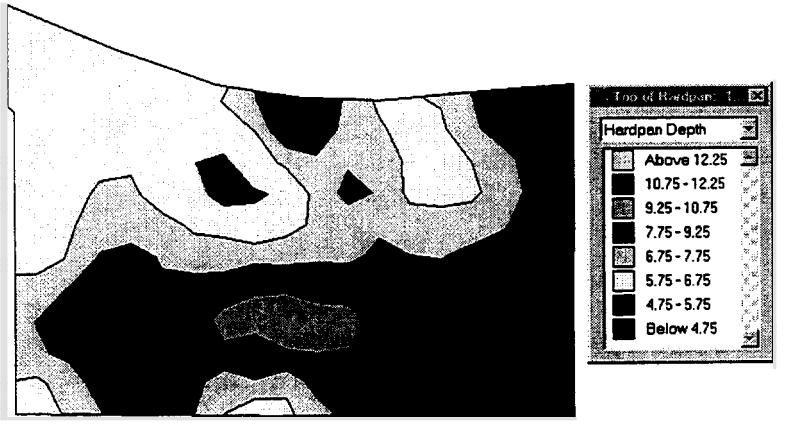
Morehouse Parish – Mer Rouge, LA Area:

Hardpan depth and thickness was evaluated using 1.0-acre grids in a 48-acre irrigated field on October 9, 1996. Rilla Silt Loam was the predominant soil type in this field. Maps illustrating hardpan data are shown below.

Base Data & Sample Sites - Hardpan Depth: 10-09-96
Min. 5.0" - Avg. 8.0" - Max. 12.0"



Hardpan Depth: 10-09-96
Min. 5.0" - Avg. 8.0" - Max. 12.0"

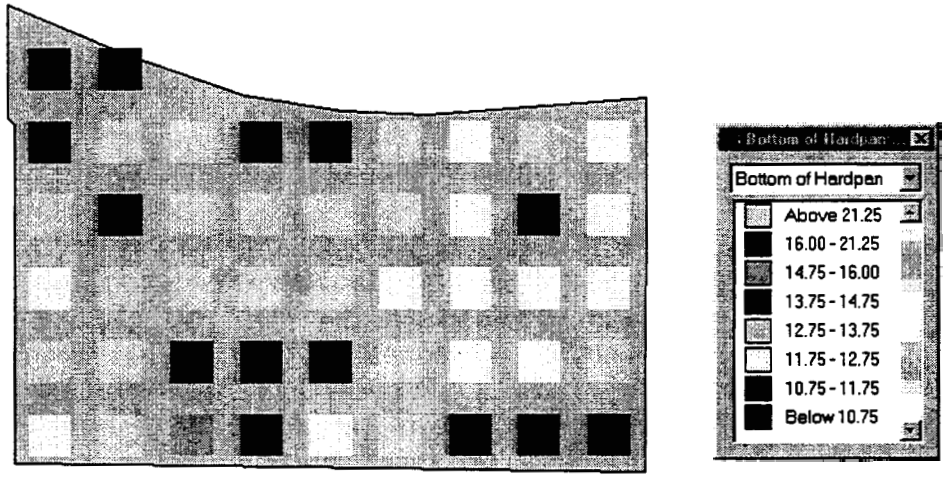


Nolan Clark Farm - Morehouse Parish
Richard Letlow, County Agent
Planted Area: 44.8 Acres

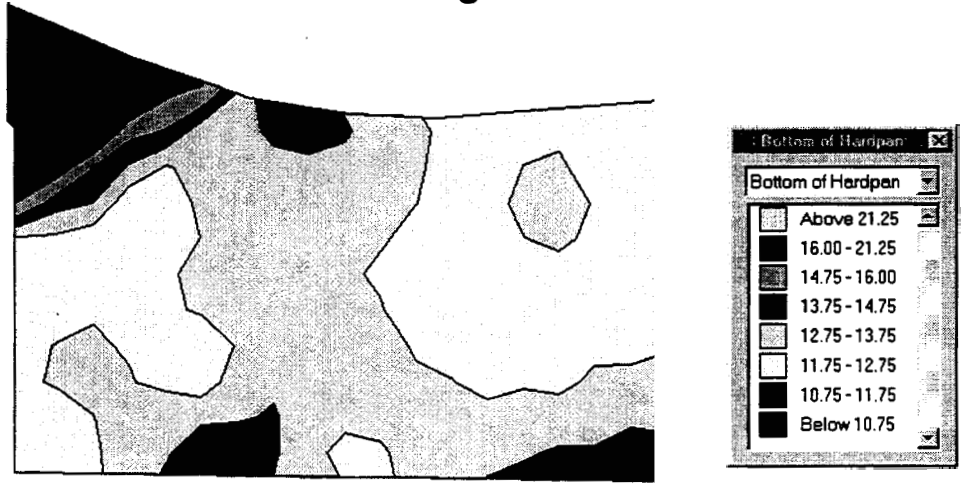
N.Clark99
11-10-99
Scale: 1"=350

Hardpan depth was 9 inches or less in 42 of the 47 grids in this field. The distance from the soil surface to the bottom of the hardpan was 14 inches or less in 43 of the 47 grids. This would indicate that a subsoiling depth of 15 to 16 inches would fracture the hardpan in these areas. The other four grids had a different soil type. The bottom of the hardpan was below the depth of a normal subsoiling operation. However, subsoiling 15 to 16 inches deep should fracture an area large enough to improve plant root development and increase soil water storage.

Base Data & Sample Sites - Bottom of Hardpan: 10-09-96
Min. 11.0" - Avg. 13.0" - Max. 21.0"



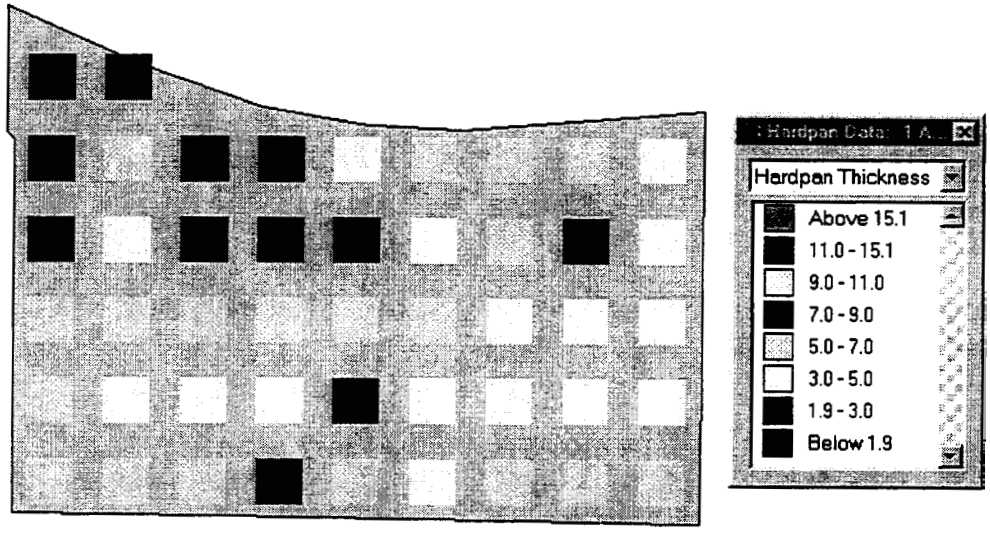
Bottom of Hardpan: 10-09-96
Min. 11.0" - Avg. 13.0" - Max. 21.0"



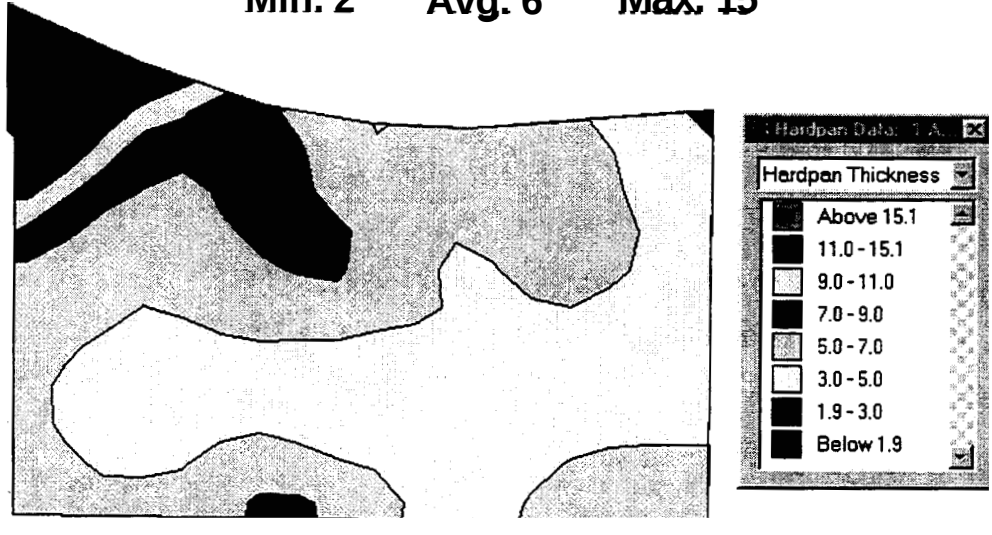
Nolan Clark Farm - Morehouse Parish
Richard Letlow, County Agent
Planted Area: 44.8 Acres

NClark99
11-10-99
Scale: 1"=350

Base Data & Sample Sites - Hardpan Thickness: 10-09-96
Min. 2.0" - Avg. 6.0" - Max. 15.0"



Hardpan Thickness: 10-09-96
Min. 2" - Avg. 6" - Max. 15"



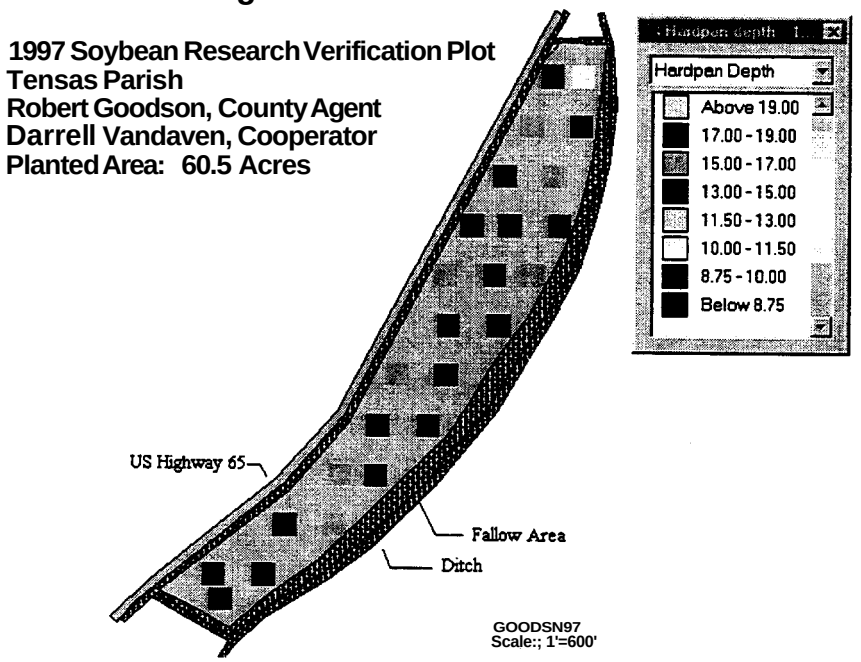
Nolan Clark Farm - Morehouse Parish
Richard Letlow, County Agent NClark99
Planted Area: 44.8 Acres 11-10-99

This field was checked for compaction a second time on November 10, 1999. The cooperator had adopted a permanent row, controlled traffic tillage system. Annually subsoiling the drill area had removed the compacted layer in this area.

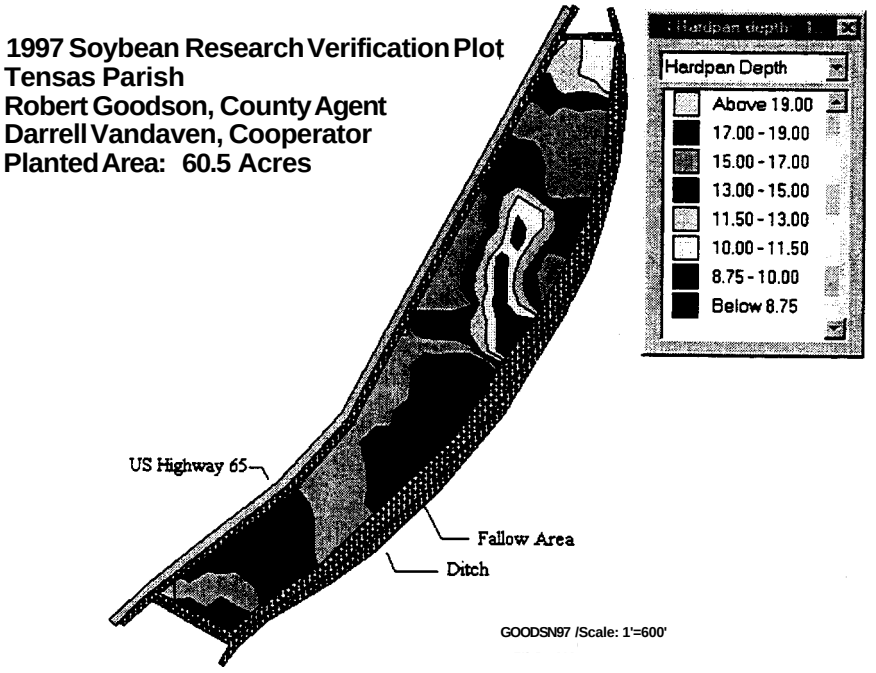
Tensas Parish - St Joseph, LA Area:

Hardpan depth was evaluated using 2.4-acre grids in **a** 60.5-acre field on October 16, **1997.** Silty Clay was the predominant soil type in this field

Base Data &Sample Sites - Hardpan Depth: 10-16-97
Min. 9.0" - Avg. 15.1" - Max.18.8"



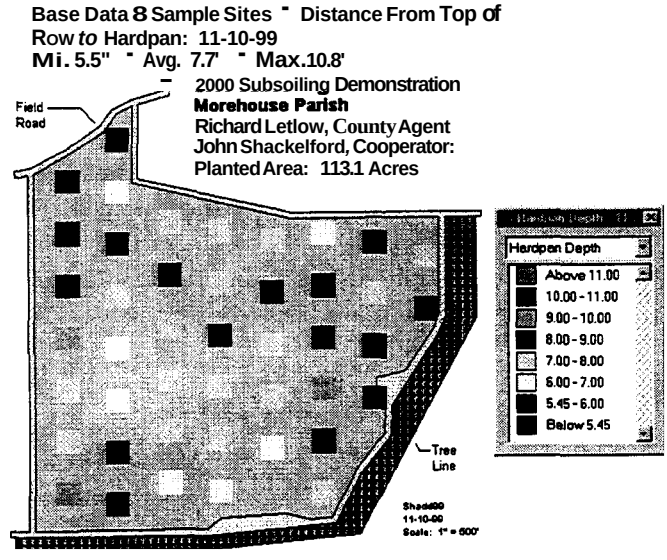
Hardpan Depth: 10-16-97
Min. 9.0" - Avg. 15.1" - Max. 18.8'

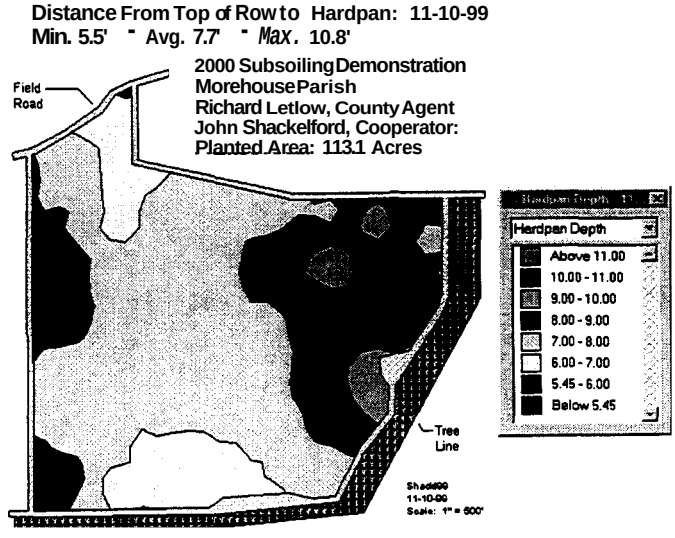


Hardpan depth was less than 15 inches in 9 of the 25 grids. This would indicate that subsoiling would probably increase yields in 36% of this field. Hardpan depth was 15 inches or more in 64% of the field. It is doubtful if subsoiling would increase yields in this area. The compacted zone was too thick to determine the distance to the bottom with the soil compaction tester. The color-coded map indicated that the compacted zones were located in the north and center portion of the field. This map can be used as a guide for subsoiling areas where hardpan depth is less than 15 inches.

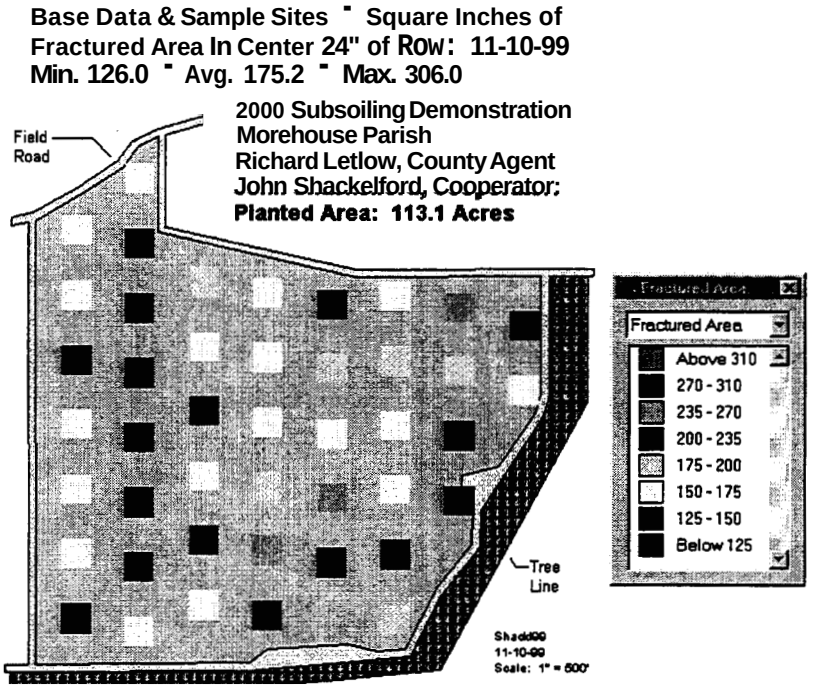
Morehouse Parish - Bonita, LA Area:

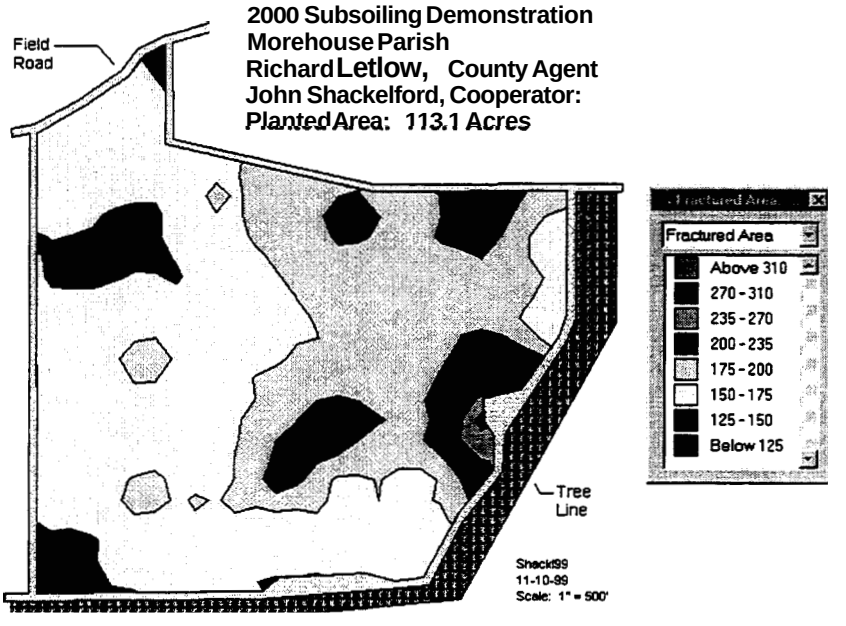
Hardpan depth was evaluated using 2.57-acre grids in a 113.1-acre field on November 10, 1999. Sandy Loam was the predominant soil type in this field. The producer was using a permanent row, controlled traffic system. However, this field had not been recently subsoiled. Hardpan depth was measured from the center of the row to the top of the hardpan or compacted layer. Hardpan depth varied from 5.5 to 10.8 inches with an average of 7.7 inches.





The hardpan depth in the drill area was also measured in 3-inch increments from 12 inches left to 12 inches right of the row centerline. This data was used to compute the square inches of fractured area in the center of the row. Fractured area ranged from 126 to 306 square inches with an average of 175 square inches.





Based on the shallow hardpan depth, the cooperator subsoiled the drill area. Compaction in this field will be evaluated after harvesting the 2000 crop. Based on the hardpan depth and fractured area, a decision will be made concerning subsoiling for the following years crop.

Conclusions:

This limited evaluation of compaction on cooperating producers fields indicates that a soil compaction tester, GPS and mapping software can be used to evaluate soil compaction problems. This technology can be used to record compaction data and compare changes from year to year. This will allow producers to more accurately determine if subsoiling is justified and then subsoil only those areas of the field where subsoiling is most likely to increase yields.

It is recommended that these demonstrations be continued to develop a better understanding of the processes involved in the reforming of compacted layers in fields with permanent row, controlled traffic tillage systems.