Water Table Level as Influenced by Rainfall, Crop Requirements, and Tiling Method

Jeff Cook, research technician
National Soil Tilth Laboratory
Ken Pecinovsky, farm superintendent

Introduction

In 1979, a portion of the research farm was tiled in a pattern to provide a good soil environment for large-tillage trial plots. This was used as an opportunity to compare tile installation methods, one using a conventional trenching machine and another using a trenchless "tile plow" machine. The tile plow inserted plastic tile using a mole approach, which opened the soil and inserted the tile without leaving an open trench that would later require backfilling. The heaving of the soil by the tile plow did require some soil manipulation to allow cropping. Past research on this study has shown that plowing and trenching methods were not significantly different and that water table measurements were influenced more by timing of water needs of the crop being grown and intensity of the rainfall events.

Materials and Methods

Four-inch plastic subsurface drainage tile was installed in sets of three at 80-ft spacing by the contractor so that the water table depth could be measured at intervals (10 ft, 20 ft, and 40 ft) from the center tile. Groundwater table–depth observation wells were installed, and records of depths to the water table (to a 5-ft depth) have been maintained.

Results and Discussion

Figure 1 shows the water table measurements and weekly rainfall for 2003–2005. It is generally believed that when the water table is at least 12 in. below the surface, it does not interfere with machine traffic or plant growth. Using that as a standard, it is easy to see that only once in the past three years was the water table depth less than 12 in. from the surface. Good agricultural soils hold about 10 in. of available water in the upper 5 ft of the soil profile.

In 2003, plantings were delayed for the first two weeks of May due to high rainfall events. Water tables remained 8 to 26 in. from the soil surface for most of May and June. Only 0.49 in. of rainfall occurred in August, and tile drainage stopped due to water demands of the crop and remained dry through spring 2004. Well-drained soil types yielded badly while poorly drained soil types yielded average to excellent.

In 2004, tile lines were running and water tables were at 1 ft above the tile line depth on March 29 due to 2.37 in. of rain from the previous week. They remained at that level until mid-May. Two major rainfall events, on May 21 and May 28 totaling 8.61 in. of rain, caused severe erosion, but they did not raise water tables within 2 ft of the surface due to excess surface runoff. Water tables remained 30 in. above tile depth throughout most of June. Despite timely ample rainfall throughout the rest of the season, water tables remained dry or at tile line depth from the end of August through harvest due to crop demand for water.

In 2005, tiles were not running; thus, there were no water tables until May 13, even though 3.61 in. of rain had fallen in the previous 2 months, indicating that the soils were not fully recharged to field capacity from the previous fall and winter precipitation. Rainfall the second and third week of May made planting difficult. Ample water was available to the crop through July 29. August started out dry, but 3.8 in. of rain fell the week of August 12, bringing water tables back up, followed by 6.62 in. of rain in September. Tile lines remained running and water tables remained at least 1 ft. above the tile line depth throughout the fall season. Severe compaction was caused by combines during the September soybean harvest.

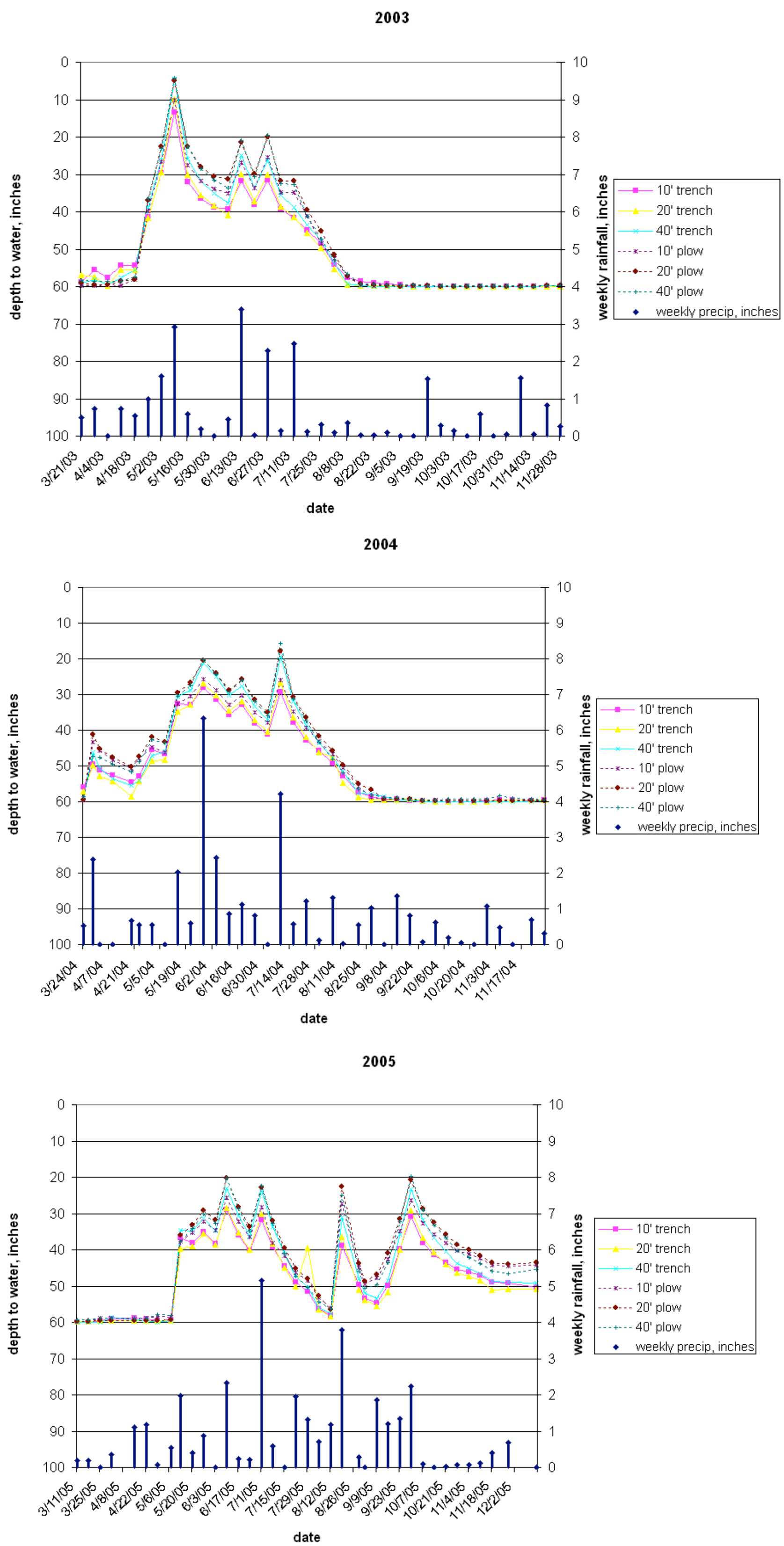

Figure 1. Comparison of water table depths and rainfall for two tile installation methods, twenty-five years later.