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Water Table Level as Influenced by Rainfall, Crop Requirements, and Tiling Method during the past Three Years

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Water Table Level as Influenced by Rainfall, Crop Requirements, and Tiling Method during the past Three Years

Abstract

In 1979, a portion of the research farm was pattern tiled including the large tillage plots. This was used as an opportunity to compare tile installation methods: a conventional trenching machine (used widely prior to late 70s), and a trenchless “tile plow” machine. The tile plow inserted plastic tile using a mole approach, which is the current primary tiling method. This research showed that plow and trenching tiling methods were not significantly different and both provided adequate drainage. It also showed that water table measurements were influenced more by timing of water needs of the crop being grown and intensity of the rainfall event than tiling method. This report focuses on continued research completed on these trial plots from 2009 to 2011 measuring water table level.

Keywords

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Disciplines

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Water Table Level as Influenced by Rainfall, Crop Requirements, and Tiling Method during the past Three Years

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Introduction

In 1979, a portion of the research farm was pattern tilled including the large tillage plots. This was used as an opportunity to compare tile installation methods: a conventional trenching machine (used widely prior to late 70s), and a trenchless “tile plow” machine. The tile plow inserted plastic tile using a mole approach, which is the current primary tiling method. This research showed that plow and trenching tiling methods were not significantly different and both provided adequate drainage. It also showed that water table measurements were influenced more by timing of water needs of the crop being grown and intensity of the rainfall event than tiling method. This report focuses on continued research completed on these trial plots from 2009 to 2011 measuring water table level.

Materials and Methods

Four-inch plastic subsurface drainage tile was installed in sets of three at 80-ft spacing by each tile machine 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 water table (to a 5-ft depth) have been maintained. The water table depth was measured every two weeks during the growing season from 2009 to 2011.

Results and Discussion

During 2009–2011, the water tables tended to be higher away from the center tile line during high water tables, but little to no differences in

water tables measurements occurred during low water tables. Only slight drainage differences were noted by tiling method in early years, which were considered insignificant compared with the cost savings of the tile plow method.

Figure 1 shows the water table measurements and weekly rainfall for 2009-2011. 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 has only occurred once, on March 12, 2010 from snow melt. Corn and soybeans have similar available soil moisture requirements. The critical difference is time of season at which limited moisture can most affect the crop (mid- to late-July for silking corn and early August during initial soybean seed development). Seasonal available soil moisture requirements are 21 in. of water. Due to losses from runoff and percolation through the soil, we estimate this requirement at 25 in. of water for the season. Good agricultural soils hold about 10 in. of available water in the upper five feet of the soil profile. Corn and soybean typically root to at least a 5-foot depth. If we start with a “full” soil moisture profile (10 in.), then we need an additional 15 in. of timely season rainfall to grow a crop. Average soil moisture losses from crop growth and evaporation from the soil are (April-1.3 in., May-2.7 in., June-3.65 in., August-4.45 in., September-2.15 in., October-1.10 in.) for a total of 21 in.

In 2009, minimal rainfall occurred in April until the last week of the month. Field planting started in mid-April through April 24. Only four days were suitable for field work in the first half of May due to frequent rains. The

water tables rose above tile line levels. Planting was completed from May 18 through May 25. June through August rainfall averaged 3.7 in. per month, followed by below normal September rainfall. No rainfall occurred from August 27 through September 21, tile drainage stopped, and water tables lowered to tile line levels after August 21. Crop yields were not affected because of cool air temperatures, which reduced any crop stress. Corn and soybean harvest was delayed due to delayed crop maturity, high grain moisture, and frequent rains in October, which increased water tables after October 16.

In 2010, warm temperatures caused a massive snow melt, which was able to take the frost out of the ground around March 11. Water tables rose to near 1 ft from the soil surface. Moderate rainfall during April and May provided an opportunity for early planting with completion around mid-May. Water tables were within 10 in. of the soil surface in late June, but did not affect field operations, because spraying and row cultivating could be delayed. Tile drainage stopped by August 27 and never increased due to below normal September (1.7 in.) and October (0.43 in.) rainfall. Nearly 26 in. of snow in December

2010 replenished soil water reserves when the majority of it melted in the last three days of December. An additional 26 in. of snow from January through April 2011, replenished soil water holding capacity for adequate moisture reserves for the 2011 crops.

In 2011, frequent rains, below normal air temperatures, and 3 in. of snow delayed field work and planting in April. The tile flow started and water tables rose after April 22. Measurable rainfall occurred on 14 days in May, however most corn plantings occurred after mid-May, when plantings were completed. Water tables were never within 20 in. of the soil surface during the entire growing season. No surface erosion occurred in 2011, because no rainfall event exceeded 2 in. Tile lines stopped running and water tables were at tile line depth (4 ft) after August 5, meaning that we had just enough soil moisture to produce a high yielding crop.

Soil moisture is a concern in 2012, if normal spring and summer time rainfall patterns don't materialize, because soil moisture reserves were not replenished in fall 2011. The winter of 2011–2012 has had a low amount of snow, with only 19.0 in. as of March 20, 2012.

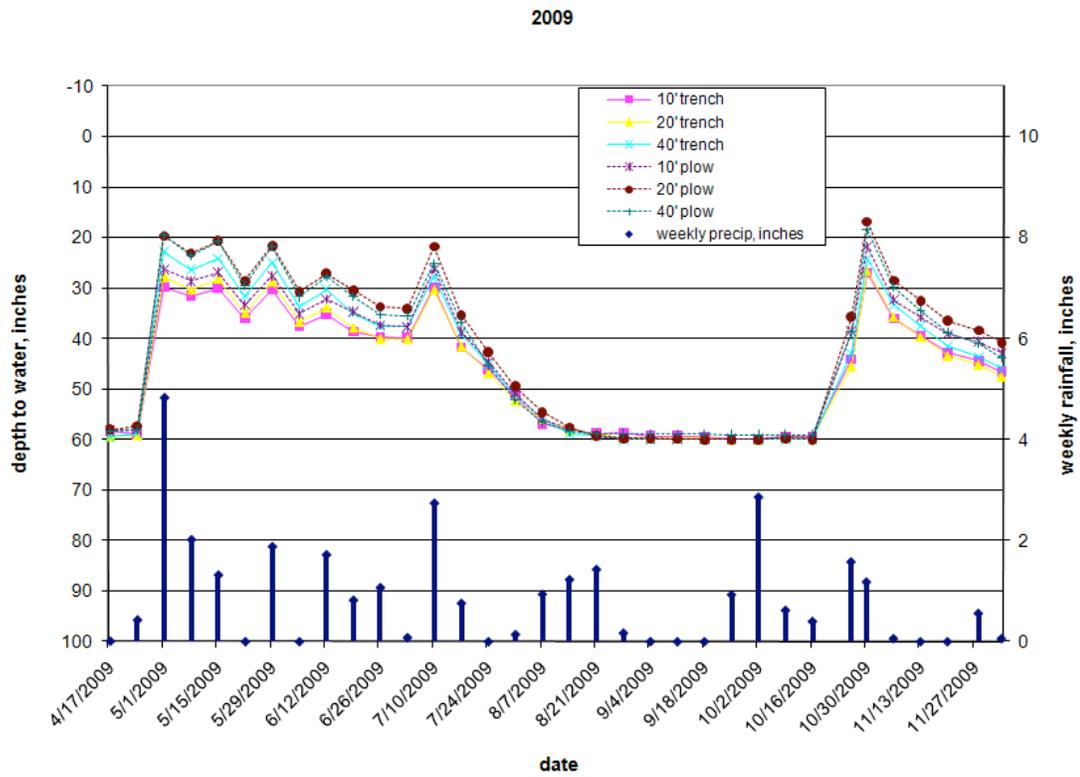


Figure 1. Water table and weekly precipitation in 2009 as was done in the 2008 update on the same topic.

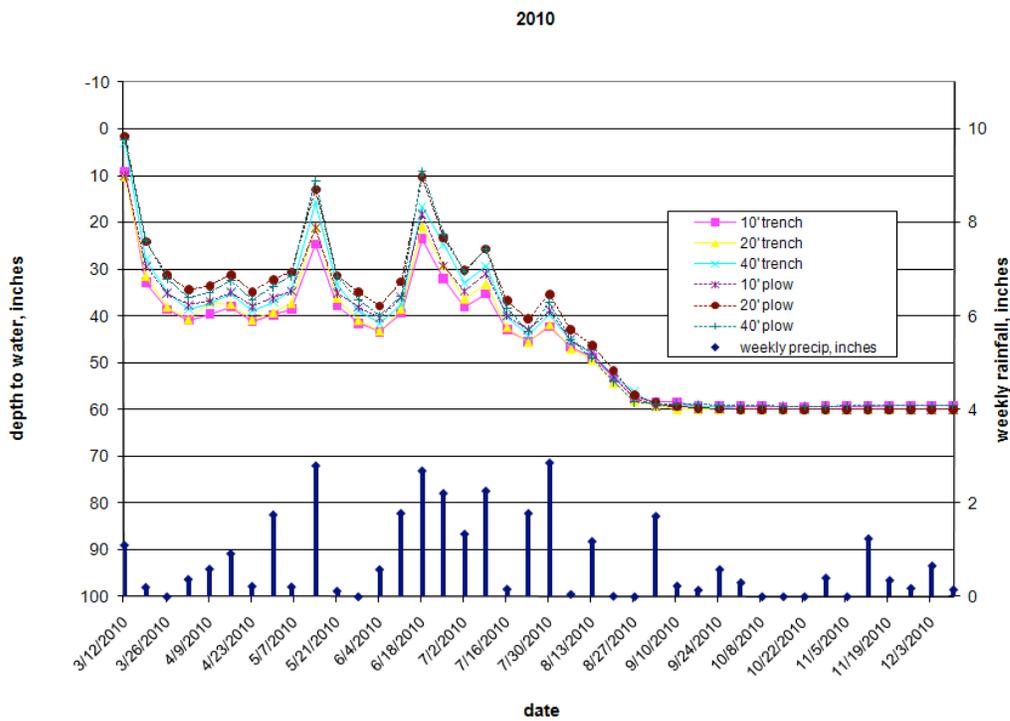


Figure 2. Water table and weekly precipitation in 2010 as was done in the 2008 update on the same topic.

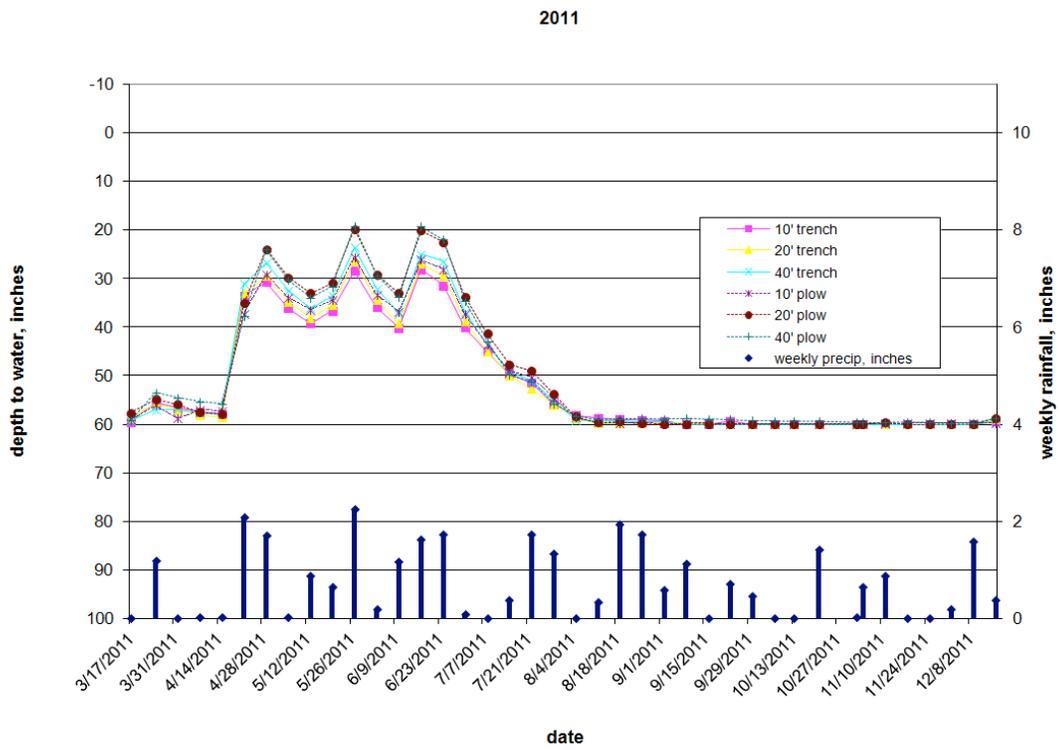


Figure 3. Water table and weekly precipitation in 2011 as was done in the 2008 update on the same topic.