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Water Table Level as Influenced by Rainfall, Crop Requirements, and Tiling Method During the Past Two Years

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Abstract

In 1979, a portion of the research farm was pattern tiled. This was used as an opportunity to compare tile installation methods: a conventional trenching machine (used widely prior to late 1970s) 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 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 water table monitoring from 2012 to 2013.

Disciplines

Agricultural Science | Agriculture | Water Resource Management

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Water Table Level as Influenced by Rainfall, Crop Requirements, and Tiling Method During the Past Two Years

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Introduction

In 1979, a portion of the research farm was pattern tiled. This was used as an opportunity to compare tile installation methods: a conventional trenching machine (used widely prior to late 1970s) 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 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 water table monitoring from 2012 to 2013.

Materials and Methods

Four-inch plastic subsurface drainage tile was installed at a 4-ft depth, in sets of three at 80-ft spacing by each tile machine so the water table depth could be measured at intervals (10 ft, 20 ft, and 40 ft) from the center tile. Soils were primarily a Kenyon loam with some Readlyn loam and Clyde silty clay loam. Groundwater table depth observation wells were installed, and records of depths to water table (to a 5-ft depth) have been maintained.

Results and Discussion

The water tables tended to be higher away from the center tile line during high water tables, because water slowly permeates toward the drainage lines when soils have excess

moisture. It is generally believed if the water table is more than 12 in. below the soil surface, it does not interfere with machine traffic or early plant growth. Only on a few occasions in 2012 (April 20) and 2013 (April 19, May 3, 10, 31, June 21) was the water table higher than this at some monitoring points due to excessive rain events. The majority of these times, a water table less than 12 in. only occurs in the 20 and 40 ft distances away from drainage tile. This is why many producers are adding drainage lines between old, widely spaced tile lines to speed drainage in soil types that exhibit poor drainage.

Figure 1 shows the water table measurements and weekly rainfall for 2012. The majority of farmers planted corn from April 24-27. Eight rain events occurred between April 28 and May 6, but all were less than 1 in. and allowed drainage tile to work efficiently. The topsoil was fit to continue planting soybeans and a few corn re-plantings after May 10, followed by below normal rainfall for the rest of the growing season. Water tables between March 16 and July 16 had an average of 1.8 in. difference between the 10 to 40 ft tile spacings. After July 16, 2012, water table levels were below the range of monitoring equipment due to the summer drought and high water use requirements of the crop during the excessive July heat.

In 2013 (Figure 2), water tables between April 5 and August 2 had an average of 4.9 in. difference between the 10 to 40 ft intervals from drainage tile due to excessive April through June rainfall. Most farmers planted corn the week of May 13 and finished soybeans by June 20. Many producers decided to not plant a portion of their crops due to the

wet soil conditions. After August 2, 2013, water table levels were below the range of monitoring equipment due to the crop water use requirements and below normal July rainfall.

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 can hold about 10 in. of available water in the upper five feet of the soil profile. Corn and soybeans typically root to at least a 5-ft 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., July-5.65 in., August-4.45 in., September-2.15 in., and October-1.10 in. for a total of 21 in.

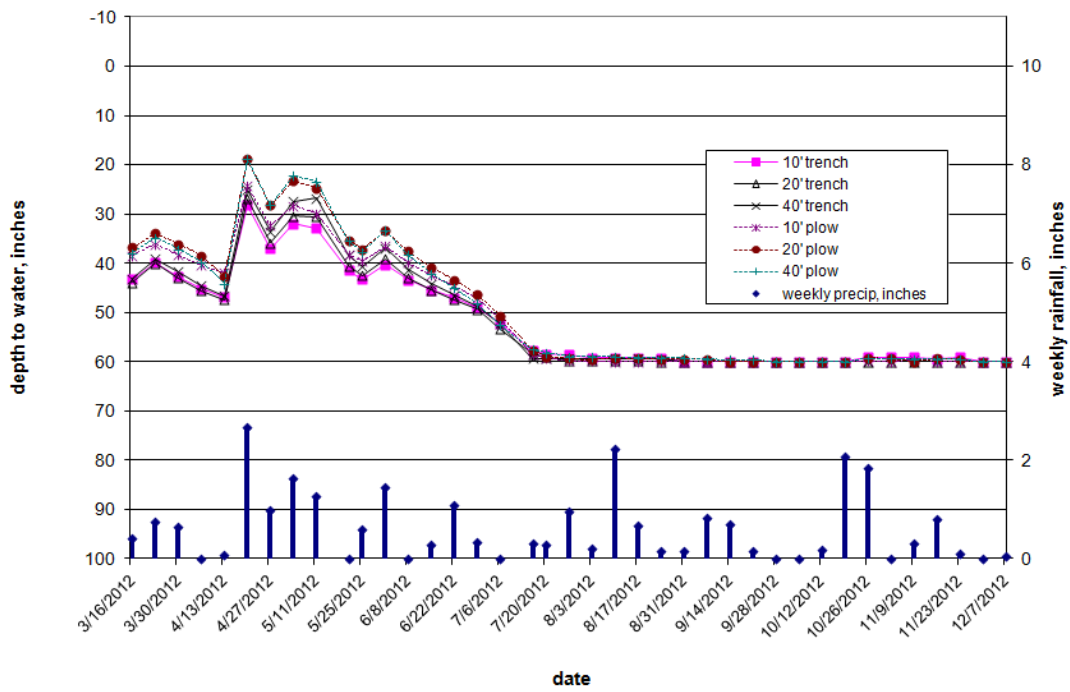


Figure 1. Water table and weekly precipitation in 2012 from two drainage installation methods at three distances.

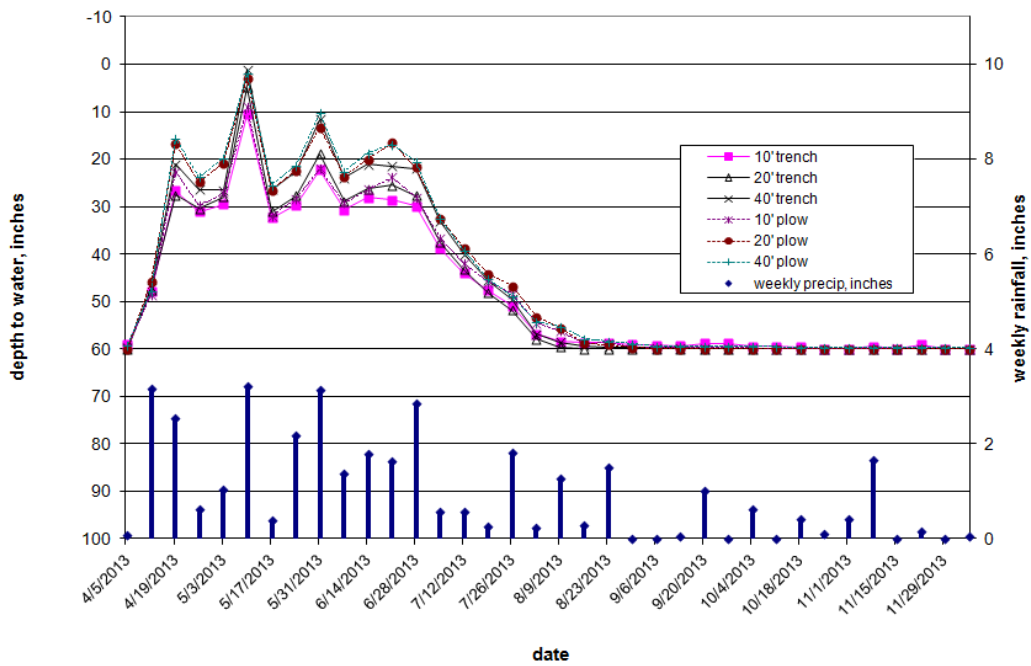


Figure 2. Water table and weekly precipitation in 2013 from two drainage installation methods at three distances.