EVALUATION OF DRAIN TILE PERFORMANCE WHEN USED IN COTTON PRODUCTION

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Abstract

This research was conducted in 2021 at the R.R. Foil Plant Science Research Center in Starkville, MS, to evaluate cotton performance when using drain tile. Drain tile was installed in late November 2020 and early January in 2021 in Starkville, MS. This research consisted of studying the effects of drain tile in an irrigated and non-irrigated study. Both studies consisted of three treatments, with two tile spacing's (4.5 and 6 m) and last treatment being no drain tile. Plots consisted of 16 – 96 cm rows that were 50 m in length and were replicated four times. Plots were arranged in a randomized complete block design. Deltapine 2127 B3XF was planted on May 15th in both the irrigated and non-irrigated study. Throughout the growing season, soil moisture was collected at 15, 30, 60, and 91 cm in each treatment using watermark soil moisture sensors. In assistance to the watermark soil moisture sensors, Precision King Telemetry units were installed to provide active soil moisture readings every 30 minutes throughout the growing season. Throughout the growing season, irrigation was applied when soil moisture sensors reached the threshold. Data collection included soil moisture, stand counts, node above white flower (NAWF), node above crack boll (NACB), and yield. All data were subjected to analysis of variance and means were separated using Fisher's Protected LSD at the 0.05 level of significance.

Introduction

Drain tile is a type of subsurface drainage, which is used to transform poorly drained soils into economically productive farmland (Gedlinske, 2014). Drain tile has been around for hundreds of years. Early settlers used drain tile to remove excess water from wetlands in order to make the ground farmable. During this period of time, drain tile was made out of clay which allowed water to enter through the pores of the clay tile. However, modern day drain tile is made up of corrugated polyethylene plastic that is perforated to allow water to move into the pipe (Gedlinske, 2014). This process allows growers to remove any excess water from a specified field. In 2017, the USDA conducted a census which estimated there was around 22.48 million ha of drain tile installed throughout the United States. However, roughly 80% of the 22.48 million acres come from 6 Midwestern states (Iowa, Indiana, Ohio, Illinois, Michigan, and Minnesota) (USDA, 2017). The majority of research associated with drain tile comes from these states which leaves researchers and growers in the Mid-south with no data to provide accurate recommendations. Over the past few years there has been an increase in the adoption of drain tile in the Mid-South and more specifically in the eastern Black Prairie of Mississippi. Little to no research exists in the Mid-south to provide accurate recommendation for growers to adopt this practice. The goal of this research is to analysis and study the effects that drain tile has on cotton growth parameters and yield performance in the Mid-South. Therefore, the objectives of this study was (1) to determine if drain tile has an effect on cotton crop performance in an irrigated and/or non-irrigated cropping system, (2) to determine if different drain tile spacing (4.5 or 6 m) has an effect on cotton crop performance, (3) to determine the return on investment for installing drain tile on cotton grown fields in Mississippi.

Methods

This research was conducted in 2021 at the R.R. Foil Plant Science Research Center near Starkville, MS. In 2021, DP 2127 was planted on May 15 at a seeding rate of 111,000 seeds/ha at a depth of 2.5 cm. Plots consisted of 16 - 96 cm rows that were 50 m in length and were replicated four times. Plots were arranged in a randomized complete block design. After plants had been established in the field, Watermark soil moisture sensors were installed at depths of 15, 30, 60, and 91 cm (6, 12, 24, and 36 in). In order to actively monitor soil moisture percentage throughout the growing season, Precision King Telemetry units were installed in each treatment. Soil moisture readings were collected every 30 minutes from time of installation until plots were harvested. Data collection consisted of stand counts, plant height and nodes at first bloom and harvest, total nodes, nodes above white flower, and nodes above cracked boll prior to defoliation. Yield were collected using a spindle picker and boll buggy equipped with weigh scales. At harvest, the middle 8 rows of the 16 row plots were harvested and weights were collected for each individual plot and calculated

out to the land hectare. Data were analyzed using PROC GLM procedure in SAS v.9.4. All data were subjected to analysis of variance and means were separated using Fisher's Protected LSD at the 0.05 level of significance.

Results

In the Irrigated study, cotton plant heights in the no-tile treatments were shorter than the tiled treatments by 4.1%. There was no other significant differences in plant growth parameters in either of the two studies. Throughout the growing season soil moisture data showed that tiled treatments consisted of lower soil moisture readings as compared to the no-tile treatment. Lower soil moisture percentage readings indicated that there was greater soil moisture available to the plants in plots that had drain tile. Data from this research also resulted no yield differences between treatments in both the irrigated and non-irrigated study. Although, there was no yield differences in treatments there were certain trends observed in the two studies. The non-irrigated study showed an increase in yield with tiled treatments as compared to the no tile treatment, whereas, the irrigated study resulted in a downward trend in yield with tiled treatments as compared to the no tile treatment. Researcher's hypothesis these trends in yield may have been caused by installation date of the drain tile. The non-irrigated study was installed in late November in 2020, whereas, the irrigated study was installed in April in 2021. Researcher's hypothesis that the non-irrigated study allowed for the soil to settle over the winter and early spring as opposed to irrigated study only have one month for the soil to settle. Future research is needed to provide accurate data of these findings. Researcher's also want to continue to monitor cotton performance over drain tile in both the irrigated and non-irrigated study.

Summary

In 2021, the growing season consisted of more than usual rainfall resulting in over half the average annual rainfall from July 1 to Nov 1 (32.1 inches) in Starkville, MS. This resulted in only watering the irrigated study one time in late August. Researcher's hypothesis that plots with tile consisted of better soil moisture throughout the growing season due to the ability to retain water with the water control structures. Future research is needed to continue to monitor the effects that drain tile has on cotton growth parameters and yield performance.

References

Gedlinske, Brian B., "Agricultural Drainage Tiles: An Overview of their Use, Benefits, and effect on Hydrology and Water Quality" (2014). Other Faculty and Staff Publications. 1.

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