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Corn Date of Planting and Depth

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Corn Date of Planting and Depth

Abstract

The exceptionally wet weather in 2019 impacted corn yield. Excessive rainfall reduced corn emergence and plant stand. Many production fields were replanted due to poor stand from flooding. In this study, corn that was planted too shallow (1 inch) or too deep (3 inches) had less yield than that planted at 2-inch depth. The best yield was observed in the corn planted on April 16, 2019. The results from this record wet year were different from previous years, when early planted corn had higher yields.

Keywords

corn planting, date of planting, depth of planting, corn maturity, cumulative growing degree days

Cover Page Footnote

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Summary
The exceptionally wet weather in 2019 impacted corn yield. Excessive rainfall reduced corn emergence and plant stand. Many production fields were replanted due to poor stand from flooding. In this study, corn that was planted too shallow (1 inch) or too deep (3 inches) had less yield than that planted at 2-inch depth. The best yield was observed in the corn planted on April 16, 2019. The results from this record wet year were different from previous years, when early planted corn had higher yields.

Introduction
Temperature and rainfall are important for crop growth and development. Growing degree days (GDD) for corn production are calculated by subtracting a base or threshold temperature of 50°F from the average daily temperature. The calculated GDD50 are available on the Kansas Mesonet website (*http://mesonet.k-state.edu/agriculture/degreedays/*). The cumulative GDD is a useful tool to estimate crop development and predict crop stage for management inputs, and is calculated by adding GDD from a date, such as day of planting, to the current day. On average, it takes 90–120 GDD for corn to emerge (*https://www.rawlins.k-state.edu/agronomy/cornmaturity.html*). Corn will silk at about 1500 GDD. Physiological maturity, or black layer, requires approximately 2670 GDD for a 110-day hybrid.

Early season soil temperatures are important for corn germination and growth. High temperatures later in the season can limit grain filling. The timing and amount of rainfall are important for crop development. Because corn only flowers once, it is very sensitive to drought during the flowering period (tasseling and silking). Insufficient rainfall can reduce the fertilization of ovules, resulting in unfertilized ovules and reduced yield. Conversely, excess rainfall during pollination can disrupt fertilization and reduce yield. Inadequate rainfall or temperatures that are too high or low may abort ovules and reduce yield. Climatic conditions cannot be managed. However, management practices can be implemented that make the best use of the environmental conditions. Corn planting in southeast Kansas begins in mid-March after soil temperatures are above 50°F. The later the corn is planted, the warmer the soil temperatures will be. However, previous research has demonstrated the need to time the flowering of corn to coincide with periods of adequate moisture in rainfed environments. Since our highest rainfall period occurs in late May, corn pollination ideally should be timed to occur prior to July 4.

This study was undertaken to explore the impact of planting date and planting depth on corn yield. Soil temperature and moisture change with depth in the soil profile. Planting at deeper depths may allow the corn roots to access more moisture. Conversely, shallower depths may have warmer temperatures and allow more rapid crop growth early in the season.

Experimental Procedures

Corn was planted in replicated plots at the Kansas State University Southeast Research and Extension Center fields in Parsons, KS, in 30 in. rows at a rate of 23,100 seeds per acre with a Monosem planter. The field was managed with conventional tillage: chisel disk, fertilized with 180-46-60 N-P-K as urea, diammonium phosphate (DAP) and potash, and field cultivated. Weeds were controlled with a pre-emerge mix of glyphosate (2 qt/a), atrazine (1.5 lb/a), and 2,4-D (1 qt/a); and a post-emerge mix of Roundup (1 qt/a), atrazine (1 lb), and 2,4-D (1 qt/a). Roundup was sprayed as needed around V6.

Treatments included four cultivars of varying maturity: 96 day (P9697); 105 day (P0589); 115 day (P1151); and 118 day (P1862). Corn was planted on three planting dates: early (March 28, 2019); mid (April 16, 2019); and late (May 16, 2019); at planting depths of 1, 2, and 3 in. Early- and mid-planted plots were harvested on September 9, 2019. Late-planted plots were harvested on October 14, 2019.

Weather data were downloaded from the Kansas Mesonet website at Parsons, KS. Growing degree days were calculated from date of planting for each of the planting dates, using a base temperature of 50°F. Daily GDD were summed to determined cumulative GDD50 for each planting date. Similarly, daily rainfall data were summed for each planting date to determine total rainfall for each planting date.

Results and Discussion

2019 was a record-setting year for rainfall in Kansas. The rain hampered field operations. It also impacted corn emergence. The early-planted corn had a reasonably dry spell immediately after planting, but cooler soil temperatures delayed emergence until approximately 18 days after planting (DAP; Figure 2). The mid-planted corn emerged at 12 DAP, while the late-planted corn emerged at 8 DAP. However, the mid-planted corn experienced a 10-day period of rain totaling 8.5 inches shortly after emergence. Similarly, the late-planted corn received 11.26 inches of rain over a 10-day period just after planting.

Corn emergence is usually delayed for early planting dates due to lower soil temperatures. This occurred in 2019 as well, with no corn emergence until after 14 days after planting for the early planting date (Figure 2). Emergence was also delayed at lower planting depths (3 inches). Emergence was more rapid in the mid-planted corn. Emergence was still delayed, however, possibly due to the heavy rainfall. Surprisingly, emergence was very delayed in the late-planted corn. This was again due to the heavy rain, as the seeds had received enough GDD for emergence. The rain also reduced the plant stand, as the best rate of emergence was less than 80%. Emergence was particularly suppressed at lower planting depths, again due to the wet soil conditions.

Accumulation of heat units was almost parallel during the growing season for all three planting dates, with an expected delay with later planting (Figure 1). Physiological maturity was similarly delayed, with the latest planting date not achieving black layer until August 29. This delayed harvest.

Yield was surprisingly consistent between planting dates, but was strongly dependent on planting depth (Figure 3). The best yield was measured at 2-inch planting depth. Either shallower or deeper planted corn had reduced yield, irrespective of planting date. Slight improvement in yield was observed at the mid-planting date. This is in contrast to previous years' data at this site, when the early-planted corn had higher yields than mid- or late-planted corn.

Acknowledgment

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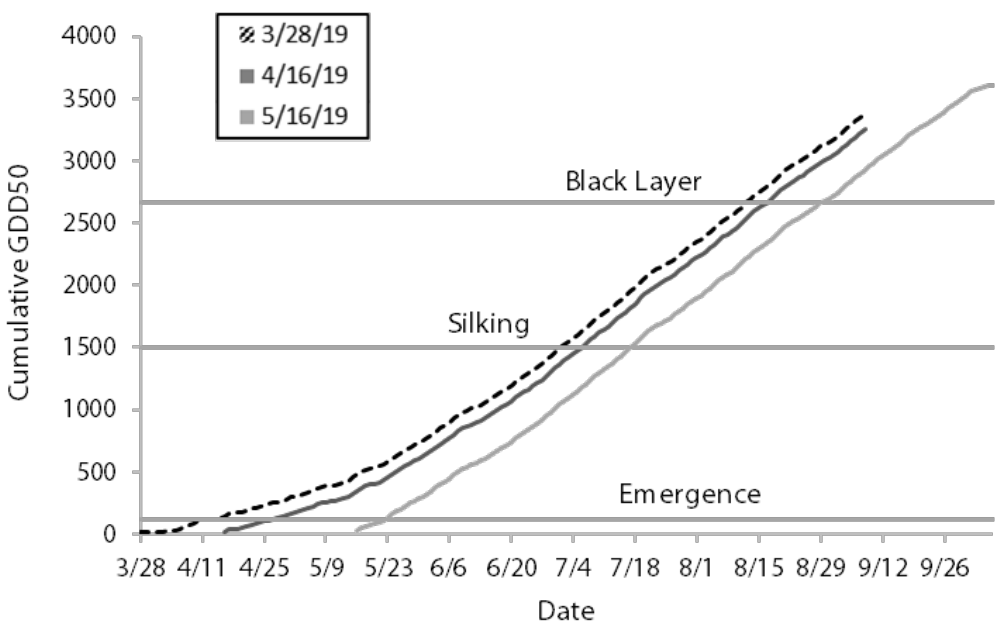

Figure 1. Cumulative growing degree days from day of planting for corn at three planting times. Estimated growing degree days for emergence (120 GDD), silking (1500 GDD) and physiological maturity (black layer, 2670 GDD) are shown.

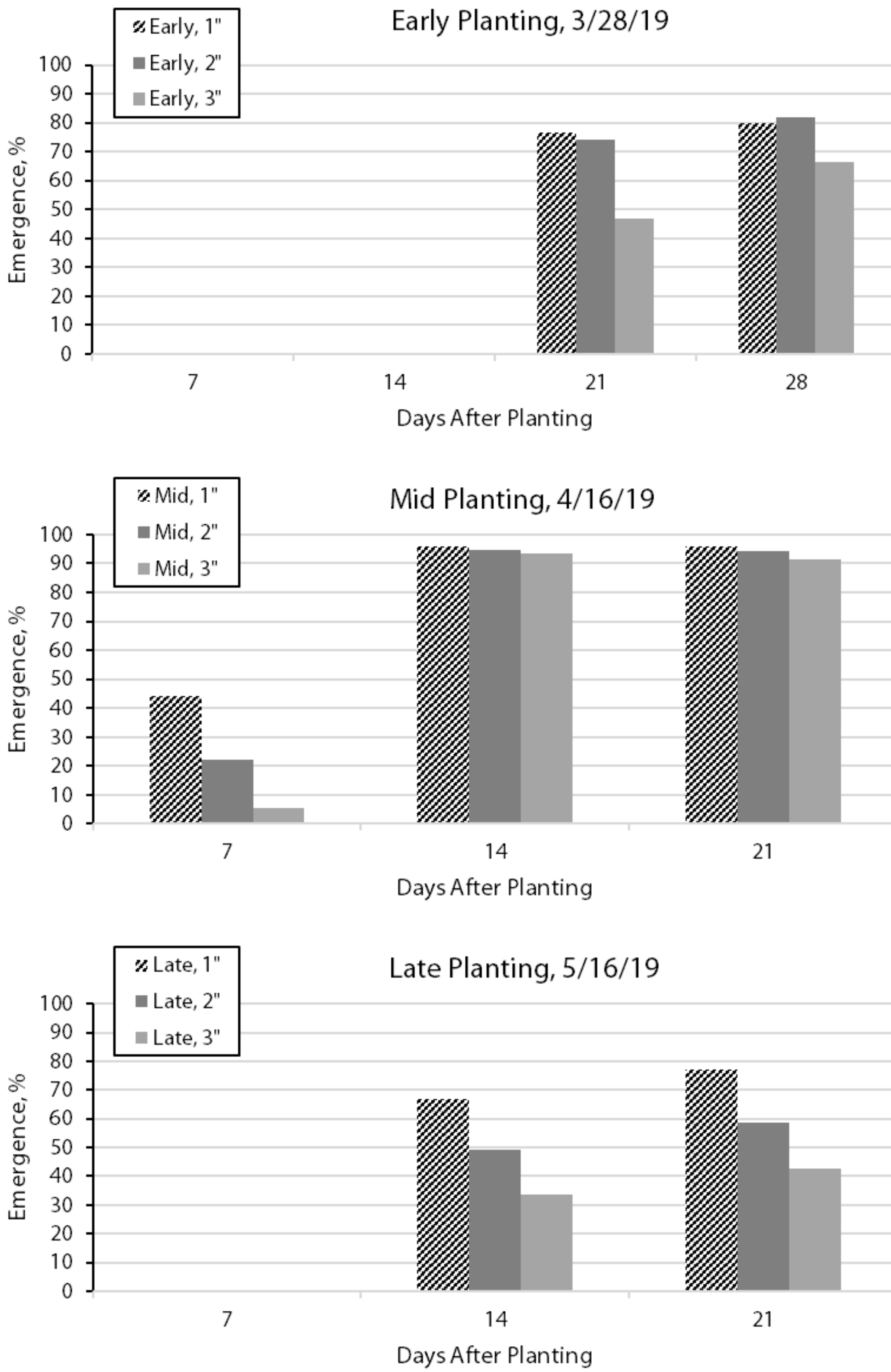

Figure 2. Emergence of corn at three planting dates and three depths.

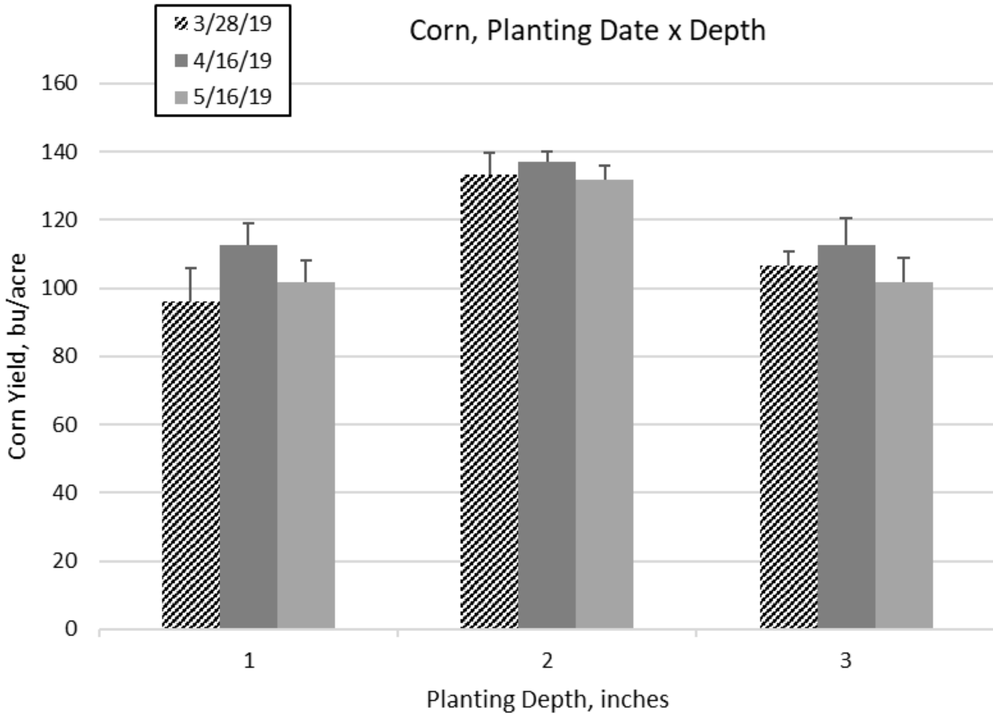

Figure 3. Corn yield in bushels/acre for three planting dates and three depths, averaged over all four cultivars. Mean + standard error are given.