

Evaluating and Updating Planting Dates for KY Corn and Soybean Production

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Rationale

The last time planting date recommendations were revised in Kentucky was more than 10 years ago. However, since then agronomic management, corn hybrids, soybean cultivars, and weather patterns have changed. For updated and accurate information, five different corn and soybean planting dates ranging from late March to early June were evaluated. Some KY producers and industry professionals feel that soybean planting date should be prior to corn. This research was conducted to determine whether the current practice of prioritizing corn planting is the more profitable than prioritizing soybean planting in KY. We will accomplish this goal by determining the date of specific growth stages, incidence and severity of diseases, infestation of insect pests, final yield and ultimately compare the profitability of each system.

Methodology

On each of five planting dates from March to June corn (Pioneer P1197 AM; DuPont Pioneer, Johnston, IA) and soybeans (Pioneer P35T58R) were planted: March 28th, April 11th, April 29th, May 28th, June 5th. Plots were 20 feet long and arranged in a randomized complete block design with four replications. Corn plots consist of four 30-inch rows while soybean plots consisted of seven 15-inch rows. All plots managed according to University of Kentucky's recommendations (Knott and Lee, 2018; Bitzer and Herbek, 2001; Anonymous, 2019). Targeted seeding rates for corn were 39,000 seeds per acre for the first two planting dates and 34,000 seeds per acre for the remaining three planting dates. For soybean, the targeted seeding rate was 145,000 seeds per acre for the first two planting dates and 118,000 seeds per acre for the remaining three planting dates.

Each week corn and soybean growth stage was determined (Lee, 2011; Knott et al., 2018). The number of days from planting to each growth stage was determined for soybeans. For corn, growing degree days (GDD) was determined.

Initial plant populations of both corn and soybeans were measured at the V2 stage. In addition percent stand establishment was determined for the initial (V2) plant population as:

$$((V2 \text{ Stands}/\text{Seeding Rate}) * 100)$$

Yield will be harvested with a Wintersteiger small plot combine (Wintersteiger, Inc., Salt Lake City, UT) equipped with a weigh system (Harvest Master, Juniper Systems, Inc., Logan, UT). Corn yield will be adjusted to 15.5% moisture and soybean yield will be adjusted to 13% moisture.

Data were analyzed with SAS (version 9.4; PROC MIXED) to determine whether differences existed.

Results and Discussion

There were two seeding rates for both corn and soybean in this study. For the first two planting dates, a greater seeding rate was used because of a greater expected stand loss in the early planting dates due to cool, moist soil conditions. Unfortunately, the initial plant populations of corn at the V2 growth stage (Lee, 2011; Knott et al., 2018) exceeded the targeted seeding at all planting dates (Figure 1). It also resulted in the stand establishment of all five of the corn planting dates to exceed 100% (Figure 2). This indicates that our corn planter seeded greater than anticipated and that the planter needs to be carefully recalibrated prior to further use.

Figure 1. Average plant population at V2 growth stage and the targeted seeding rate of corn for five planting dates at Princeton, KY, in 2019. Average populations labeled with different letters are statistically different ($P < 0.05$).

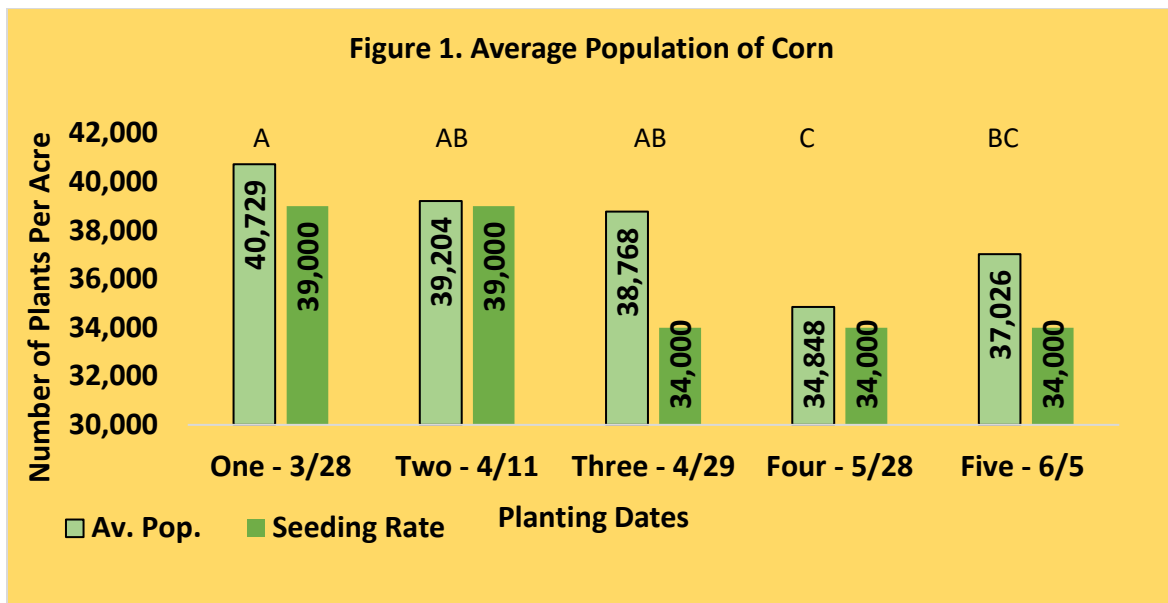
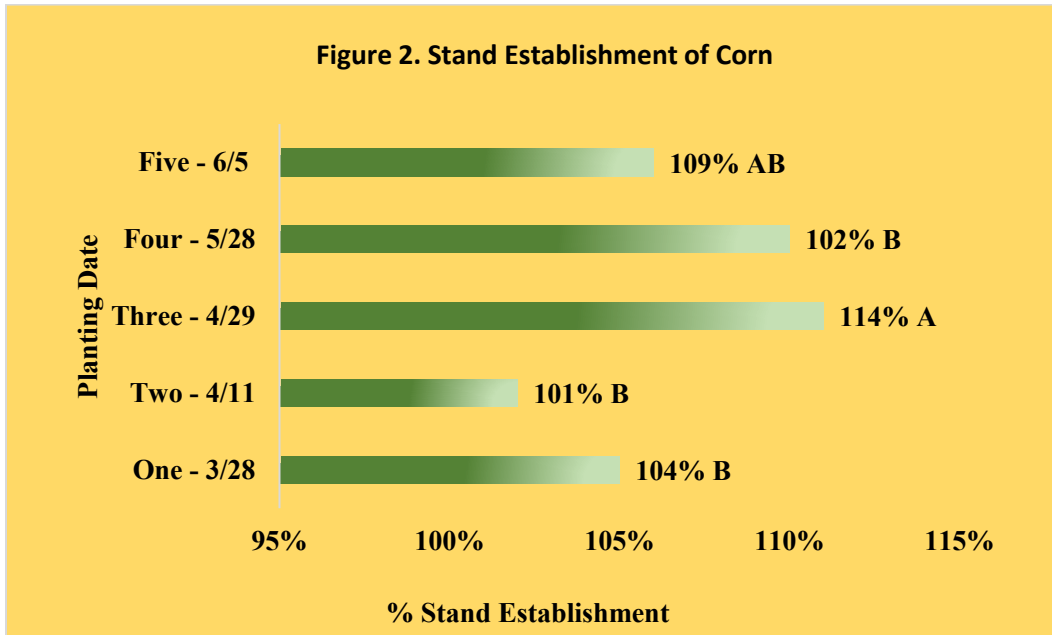


Figure 2. Average stand establishment at V2 growth stage for corn planted on five different dates at Princeton, KY in 2019. Percent stand establishment labeled with different letters are statistically different ($P < 0.05$).



In contrast, the initial plant populations at V2 growth stage for soybean were less than the targeted seeding rate (Figure 3). In some cases, such as planting date three, initial plant population was substantially less than the targeted seeding rate. Soybean stand establishment success rates were lower for the earlier planting timings compared to the later planting timings (Figure 4). So the question remains, should soybeans be planted prior to corn.

Figure 3. Average plant population at V2 growth stage and the targeted seeding rate of soybeans for five planting dates at Princeton, KY, in 2019.

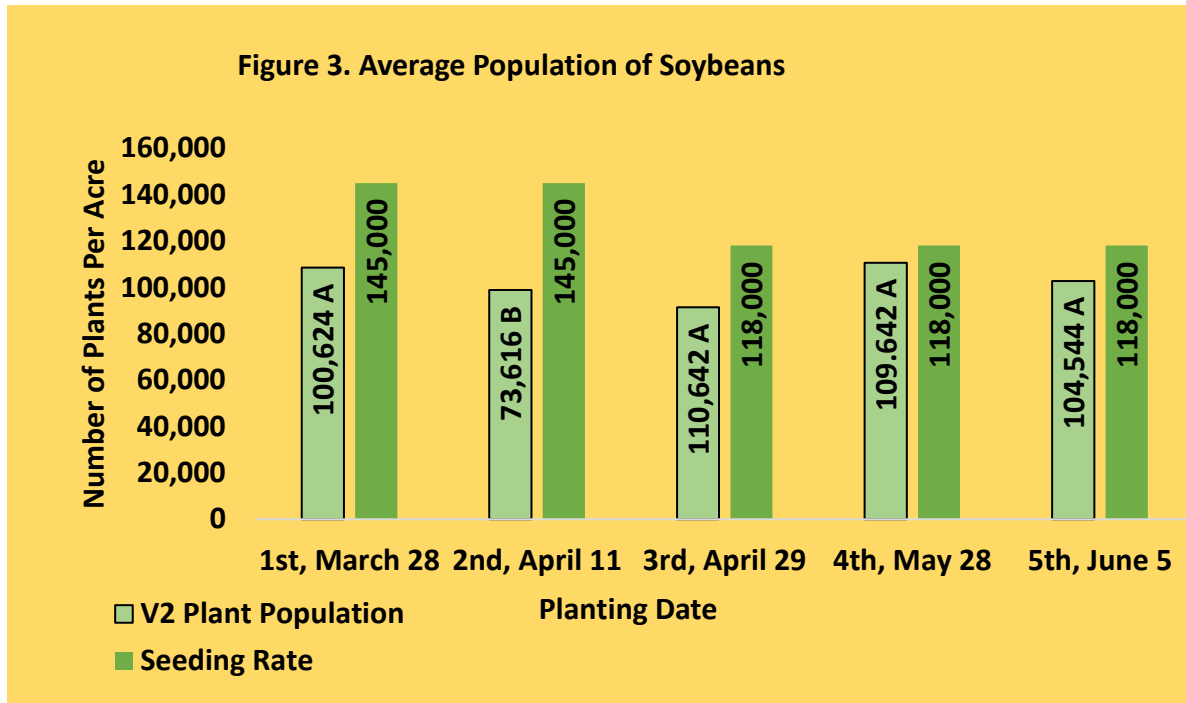
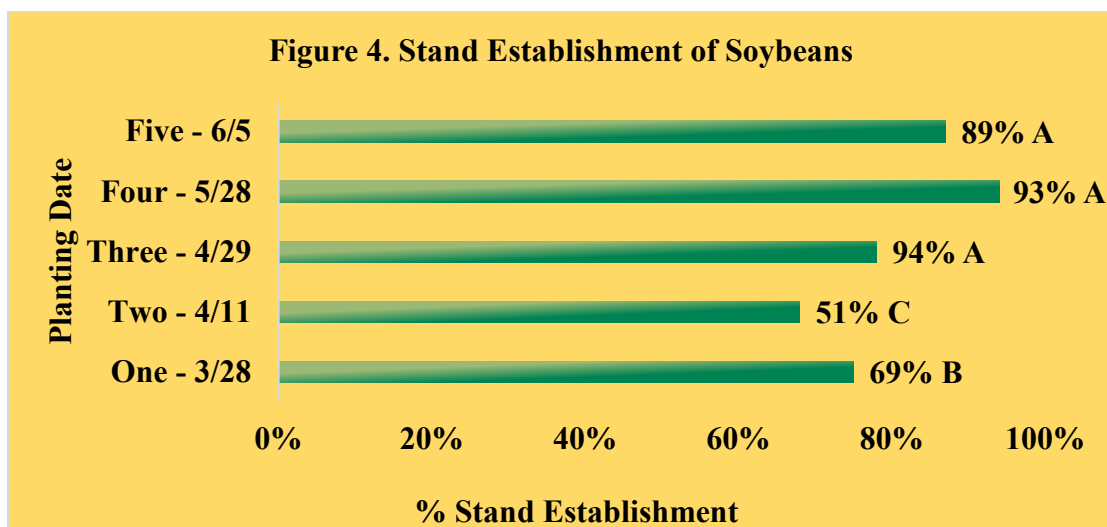


Figure 4. Average stand establishment at V2 growth stage for soybeans planted on five different dates at Princeton, KY in 2019. Percent stand establishment labeled with different letters are statistically different ($P < 0.05$).



Corn development is highly dependent to temperature and heat accumulation; so, we calculated the growing degree days of each plot to determine the heat accumulation of each planting date. The heat accumulation triggers the corn to grow properly. In general, the accumulated GDD for corn were very similar to reach specific growth stages. Typically, when the weather is warmer, corn will grow faster and when the temperatures are cooler the corn will grow slower. In table 1, the last two planting dates took substantially less growing degree days to reach the specific growth stages than the first three planting dates.

**Growth Stages and GDD of Corn
Table 1.**

| Planting Date | V4 | V6 | V12 | VT/R1 | R3 |
|-----------------|------------------------------------|------------------------|-------------------------|-------------------------|-------------------------|
| 1 (3/28) | May 14th (GDD 572) | May 28th (GDD 901) | June 25th (GDD 1527) | June 25th (GDD 1527) | July 15th (GDD 1985) |
| 2 (4/11) | May 21st (GDD 583) | June 3rd (GDD 899) | June 25th (GDD 1397) | June 28th (GDD 1438) | July 22nd (GDD 2056) |
| 3 (4/29) | June 3rd (GDD 685) | June 10th (GDD 845) | June 26th (GDD 1211) | July 8th (GDD 1556) | July 19th (GDD 1821) |
| 4 (5/28) | June 19 th (GDD 513) | June 28th (GDD 740) | July 19th (GDD 1282) | July 22nd (GDD 1336) | |
| 5 (6/5) | June 21 st (GDD 381) | July 1st (GDD 651) | July 22nd (GDD 1166) | | |

For soybeans, the days to specific growth stages were determined because they are photo period sensitive which means they do not develop based only on heat accumulation; the length of daylight impacts their development. Therefore, development is not typically determined using only growing degree days. In order for soybeans to grow, the day must be shorter than a critical value of the darkness of the night. In contrast, the number of days for soybean were not as similar. Soybeans in the last two planting dates are substantially less than the first three planting

dates, which means the soybeans grew at a faster pace the later they were planted; however, this does not mean that those soybeans with the longer amount of time to grow will ultimately be a better crop.

**Growth Stages of Soybeans
Table 2.**

| Planting Date | V2 | V6 | R1 | R3 |
|-----------------|-------------------------------------|------------------------------------|------------------------------------|------------------------------------|
| 1 (3/28) | April 30 th (33 days) | May 21 st (55 days) | May 29 th (63 days) | June 28 th (93 days) |
| 2 (4/11) | May 6 th (25 days) | May 28 th (47 days) | June 3 rd (53 days) | July 8 th (88 days) |
| 3 (4/29) | June 3 rd (35 days) | June 11 th (44 days) | June 17 th (50 days) | July 22 nd (82 days) |
| 4 (5/28) | June 17 th (21 days) | July 1 st (35 days) | July 8 th (42 days) | |
| 5 (6/5) | June 28 th (23 days) | July 8 th (33 days) | July 18 th (43 days) | |

In this study, we conducted research using planting dates of corn and soybeans to update recommendations to farmers across Kentucky for the optimal time to plant each crop. A popular opinion at this time, is that soybeans should be planted prior to corn. In order to have accurate and reliable data to extend to the public we conducted a research project including growth staging, stand counts, and growing degree day calculations. The average population of both corn and soybeans tells us that we need to carefully recalibrate the planter. The stand establishment indicates that all corn planting dates exceeded normal stand rates, and soybean planting dates were all below. Figure 3 and Figure 4 indicate that the later planting dates of soybeans have a better stand establishment. Corn planting dates 1-5 indicate similar stand establishment.



Future Work: This work will be repeated in 2020 with planter units that have been calibrated to ensure better plant populations.

Repeating this work in more years will allow better recommendations for Kentucky farmers.

References

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