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Effect of Late Planting Dates on Corn Yield

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Summary

Planting date studies have been conducted for corn over many years. Often the focus has been to determine optimum planting date for maximizing yield. In some areas, planting early-maturing corn hybrids as early as possible has been a successful strategy for avoiding hot, dry conditions at the critical pollination and early grain fill stages. Planting later can be an alternative strategy that attempts to avoid the most intense heat by moving the critical growth stages for corn centered around pollination to later in the growing season. This strategy has been adopted by some growers in areas that often encounter heat and moisture stress during the growing season. However, crop insurance cutoff dates for planting are earlier than some farmers may want to plant some of their corn acres. The purpose of these studies was to assess the yield potential for corn planted after the insurance planting cutoff date and to compare corn yields from a wide range of planting dates. Corn planted from the 2nd week of June until even the 4th week can yield from 50 to 70% of the highest yield of the earlier planting dates.

Procedures

Corn planting date studies were conducted at Kansas River Valley (Topeka) and East Central Kansas (Ottawa) Experiment Fields in 2018, 2019, and 2020. The experiment at Topeka was irrigated with irrigations totaling 9.5 inches applied June 8 through August 13, 2018; 3.5 inches June 30 through July 30, 2019; and 4.1 inches June 15 through August 17, 2020, via an overhead sprinkler irrigation system that applied roughly 0.8 inch of water at each irrigation event. The experiment at Ottawa received no irrigation. A single hybrid was planted at each location at four or five planting dates in 2018 and 2019, while a shorter and longer season hybrid was planted at each date and location in 2020. Corn was planted every two to three weeks from April 10 to June 11 at Topeka and from April 13 to June 29 at Ottawa in 2018, April 19 to June 11 at Topeka and from April 13 to June 28 at Ottawa in 2019; and April 10 to June 10 at Topeka and April 8 to June 8 at Ottawa in 2020. The U.S. Department of Agriculture's final planting date for corn at both locations was May 25. At Topeka, Pioneer 1197AM (111 relative maturity (RM)) was planted at 32,900 seeds per acre, and at Ottawa Pioneer 1138AM (111 RM) was planted at 26,500 seeds/a in 2018 and 2019. In 2020, DK 51-91 (101 RM) and DK 64-25 (114 RM) hybrids were planted at Ottawa, and DK 51-20 (101 RM) and DK 65-95 (115 RM) were planted at Topeka at the same seeding rates as the previous years at both locations. The experiment utilized a randomized complete block design with four replications. Individual plots were 30-ft (12 rows) wide and 30-ft long. Yields were determined from the middle two rows of each plot to avoid influence from neighboring plots. Usually, two harvest dates were required at each location to allow the later planted corn to mature and dry sufficiently for harvest. Yields were corrected to 15.5% grain moisture. Nitrogen and weed control were managed to have no effect on yields.

Results

The 2018 results for ECK and KRV were initially reported in the Kansas Field Research Report *https://newprairiepress.org/kaesrr/vol5/iss6/2/*.

In 2019, there was a cool period in early May, then temperatures were closer to average for June and July, with August cooler. Rainfall was above average for every month except July, with some months more than double the 30-year average. At Topeka, the corn emerged 10, 6, 4, and 5 days after planting for the respective planting dates.

In 2020, there were cool periods in April and May that slowed emergence of corn planted earlier, however, June was warmer and drier than normal, requiring irrigation at Topeka. July was wetter than normal with 3 times the average rainfall. Corn emergence was 19, 12, 7, and 5 days for the earliest to latest planting dates, respectively.

The 2018 and 2019 yield results from Ottawa were greatly influenced by the weather, specifically hot and dry periods in July when corn planted in early to mid-May was trying to pollinate (Figure 1). As a result, the corn planted at the end of May or first week of June yielded as well or better than the earlier planting dates because rain events occurred when the corn was pollinating (Table 1, Figure 3). Corn planted in the last week of June had good pollination weather but yielded 60–70% of the highest yields each year, reflecting the lack of growing season that reduced yield potential.

The corn yield response to planting date in Ottawa in 2020 was very different than the previous two years, with the highest yield 40 to 80 bu/a higher than the two previous years. The above-average rainfall in July (Figure 2) was favorable for pollination, resulting in the highest yields from corn planted at the end of April through mid-May for both the short and full season hybrids (Table 2, Figure 4). Corn planted in the first week of June yielded just greater than 70% of the highest yields. The full season hybrid yielded more than the short season at every planting date, indicating that switching to a shorter season hybrid due to delayed planting will not increase yield.

For all years at Topeka, the yield-limiting factor of moisture stress was greatly reduced by repeated irrigations (Figs. 5, 6), resulting in a more traditional yield response to planting date (Tables 3, 4). The highest yield was when corn was planted in the last half of April in 2018 and 2019 (Table 3, Figure 3). In 2020, the highest yield was with the April 10 planting date for both the short and full season hybrids (Table 4, Figure 7). The yield of the fourth planting date of June 11 was between 50 to 60% of the high yield each year. The full and shorter season hybrids' yields were almost equal when planted June 11. Similar to the results from Ottawa, switching from a full to a shorter season hybrid due to delayed planting did not increase yield.

Grain test weights were lower with the last planting dates at both locations for all years (Table 1-4). This reduction in grain test weight was related to the shorter grain fill period for the later planting dates.

The preliminary results from three years of experiments provide an example of how later planting date can be a viable option to avoid stressing the corn at critical stages when moisture is limiting, or when planting is delayed because of excess rainfall. The results from the irrigated experiment at Topeka illustrate that if moisture is not limiting, but planting is delayed, corn can still produce a substantial yield, though reduced from the potential of the optimum. These data also show the variable response to planting date in dryland production of corn in Kansas, which is often related to the conditions at pollination.

Table 1. Effect of planting date on dryland corn at the East Central Kansas Experiment Field, Ottawa, in 2019

Planting date	Grain moisture, %		Grain test weight, lb/bu		Grain yield, bu/a		Percent high yield, %	
16-Apr	15.6	c†	56.7	a	115	ab	92	ab
6-May	16.1	c	57.3	a	112	b	90	b
31-May	17.5	b	56.2	a	124	a	99	a
28-Jun	21.8	a	51.3	b	91	c	73	c
Pr>F	<0.0001		<0.0001		0.0005		0.0005	
LSD (0.05)	1.1		1.7		9.7		8	

† Means followed by the same letter within a column are not significantly different at $\alpha = 0.05$.

Table 2. Effect of planting date on dryland corn at the East Central Kansas Experiment Field, Ottawa, in 2020

Planting date	Hybrid rel. mat.	Plant pop.	Grain moisture		Grain test weight		Grain yield		Percent high yield	
	Days	Plants/a	%		lb/bu		bu/a		%	
8-Apr	101	26572	15.0	f†	52.0	c	90.0	d	49	d
28-Apr	101	26935	16.1	e	55.5	ab	136.3	bc	74	bc
18-May	101	26862	17.5	d	55.2	a	146.2	b	79	b
8-Jun	101	26499	23.8	b	50.0	d	127.6	c	69	c
8-Apr	114	27007	17.5	d	56.3	a	153.0	b	83	b
28-Apr	114	27080	18.3	d	56.5	ab	179.7	a	98	a
18-May	114	27080	19.6	c	55.3	ab	179.1	a	97	a
8-Jun	114	27806	25.0	a	50.6	d	140.0	bc	76	bc
Pr>F		0.61	<0.0001		<0.0001		<0.0001		<0.0001	
LSD (0.05)		NS	0.9		1.2		15.7		8.3	

†Means followed by the same letter within a column are not significantly different at $\alpha = 0.05$.

Table 3. Effect of planting date on corn under irrigation at the Kansas River Valley Experiment Field, Topeka, in 2019

Planting date	Plant population	Grain moisture		Grain test weight		Grain yield		Percent high yield	
	plants/a	%		lb/bu		bu/a		%	
19-April	31878	17.8	c†	58.2	a	243	a	98	a
14-May	30625	21.1	bc	55.8	ab	213	ab	87	ab
1-June	30625	24.7	b	52.5	b	177	bc	71	bc
11-June	32375	32.3	a	47.5	c	131	c	53	c
Pr>F	0.32	0.0003		0.0021		0.0047		0.0042	
LSD (0.05)	NS	4.1		4.0		47		19	

†Means followed by the same letter within a column are not significantly different at $\alpha = 0.05$.

Table 4. Effect of planting date on irrigated corn at the Kansas River Valley Experiment Field, Topeka, in 2020

Planting date	Hybrid rel. mat.	Plant population		Grain moisture		Grain test weight		Grain yield		Percent high yield	
	days	plants/a		pct		lb/bu		bu/a		%	
8-Apr	101	29984	c[†]	12.4	f	56.4	c	192	c	77	c
30-Apr	101	29984	c	13.3	e	56.8	ab	167	d	67	d
21-May	101	35452	b	13.8	d	57.4	ab	140	e	56	e
10-Jun	101	30564	c	20.2	b	54.2	d	152	de	60	de
8-Apr	115	33323	ab	17.1	a	60.2	a	254	a	100	a
30-Apr	115	30202	c	19.6	ab	56.4	ab	230	ab	91	b
21-May	115	34413	ab	16.9	ab	60.5	ab	222	b	88	b
10-Jun	115	33904	ab	24.2	d	56.8	d	153	de	61	de
Pr>F		<0.0001		<0.0001		0.001		<0.0001		<0.0001	

[†] Means followed by the same letter within a column are not significantly different at $\alpha = 0.05$.

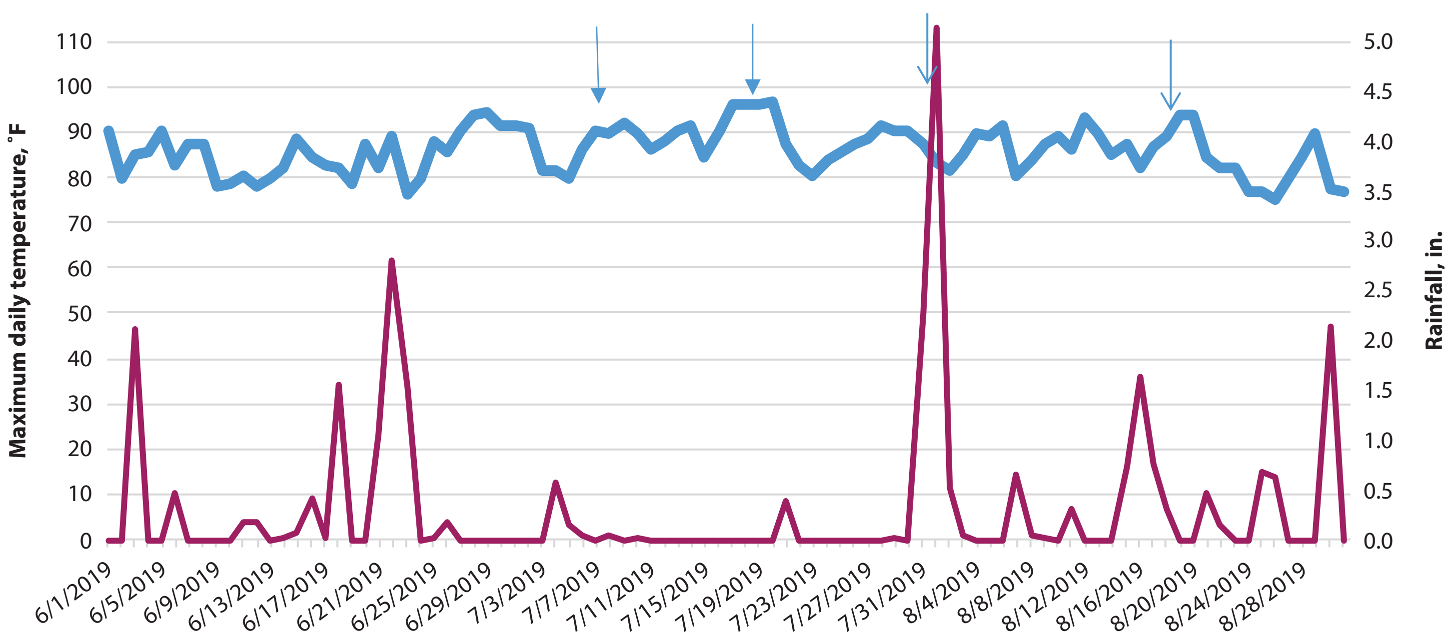

Figure 1. Daily maximum temperatures and daily rainfall at the East Central Kansas Experiment Field, Ottawa, in 2019. Arrows indicate tasseling for successive planting dates.

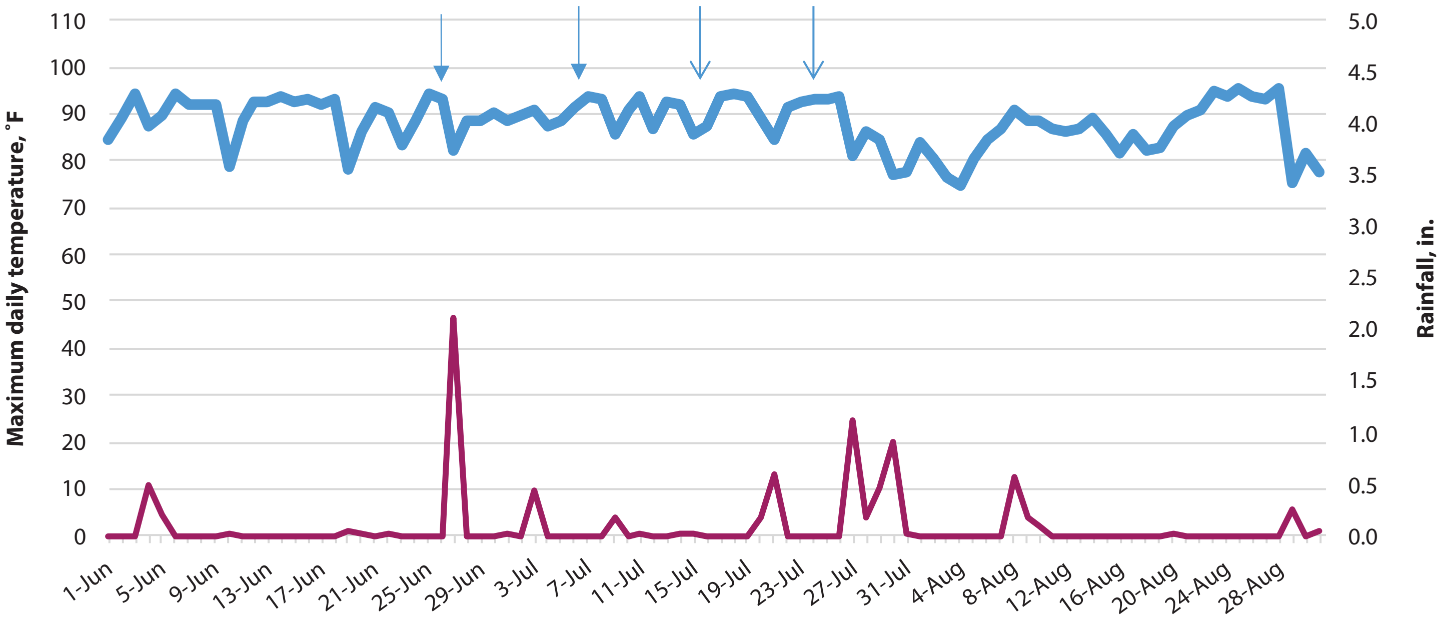

Figure 2. Daily maximum temperatures and daily rainfall at the East Central Kansas Experiment Field, Ottawa, in 2020. Arrows indicate tasseling for successive planting dates.

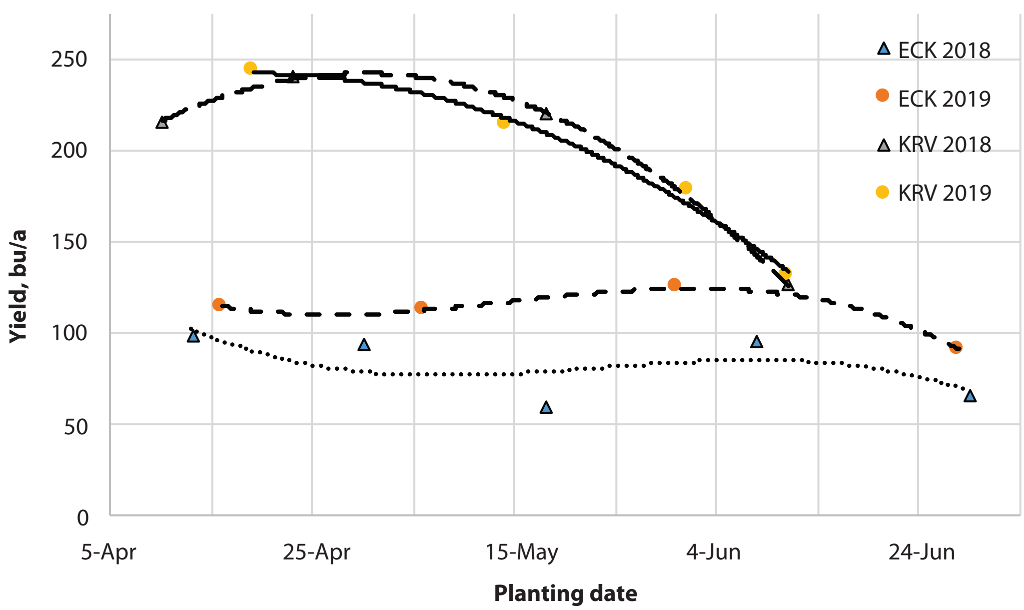

Figure 3. Yield response of corn to planting date at the East Central Kansas Experiment Field, Ottawa, and the Kansas River Valley Experiment Field-Topeka in 2018 and 2019.

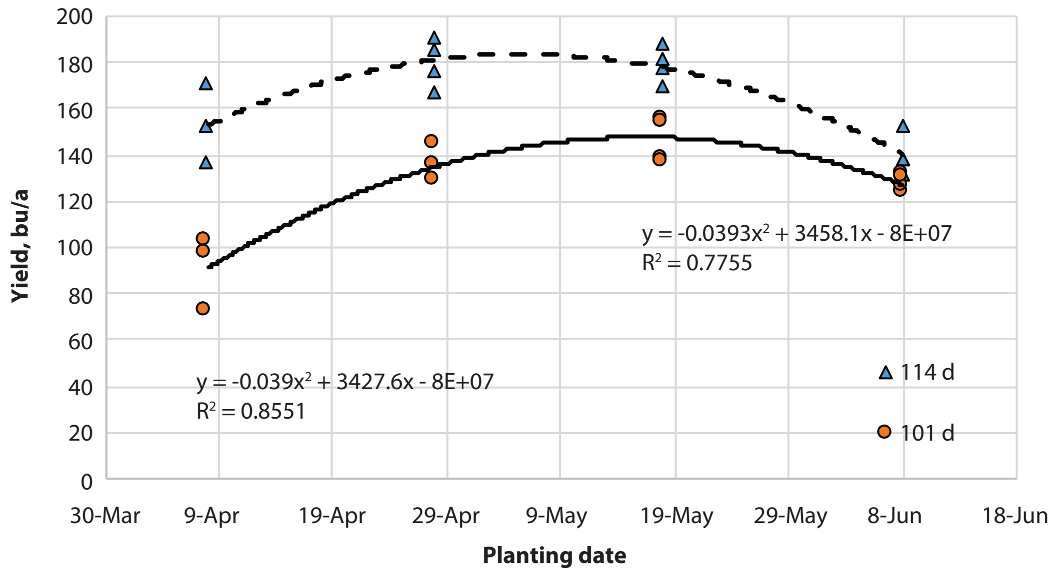

Figure 4. Yield response of full and short season corn to planting date at the East Central Kansas Experiment Field, Ottawa, in 2020.

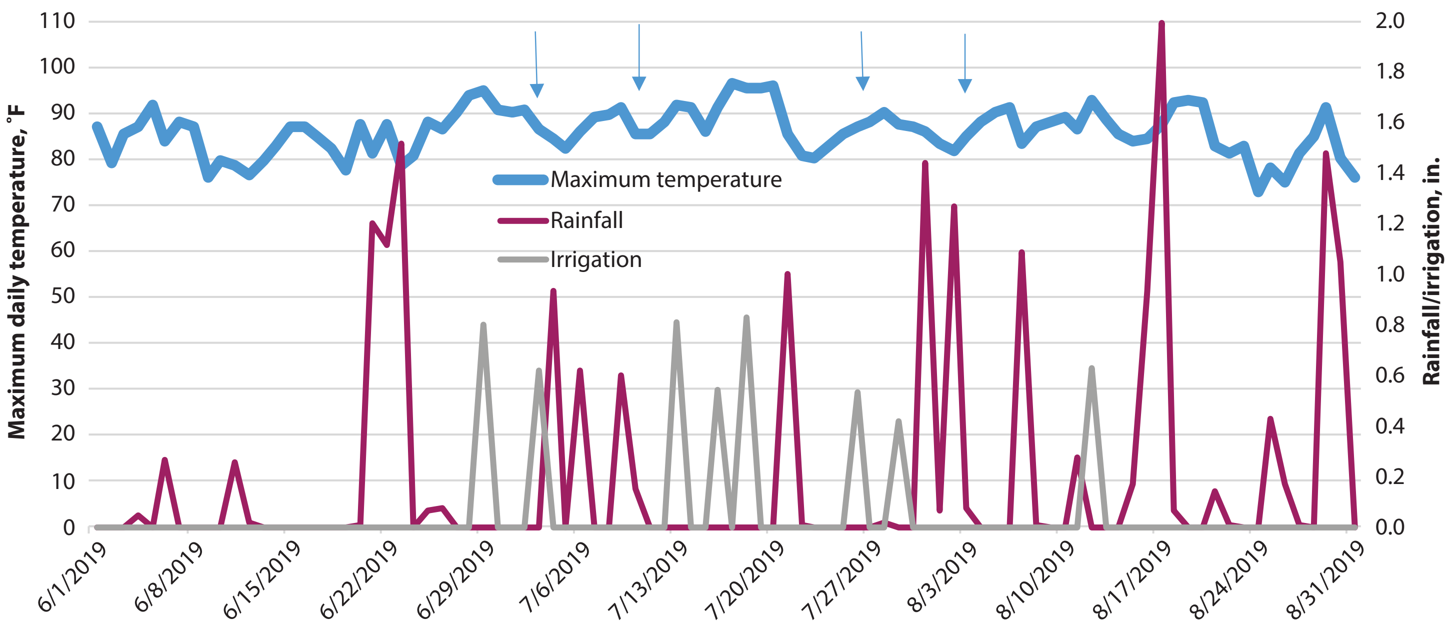

Figure 5. Daily maximum temperatures, daily rainfall and irrigation at the Kansas River Valley Experiment Field, Topeka, in 2019. Arrows indicate tasseling for successive planting dates.

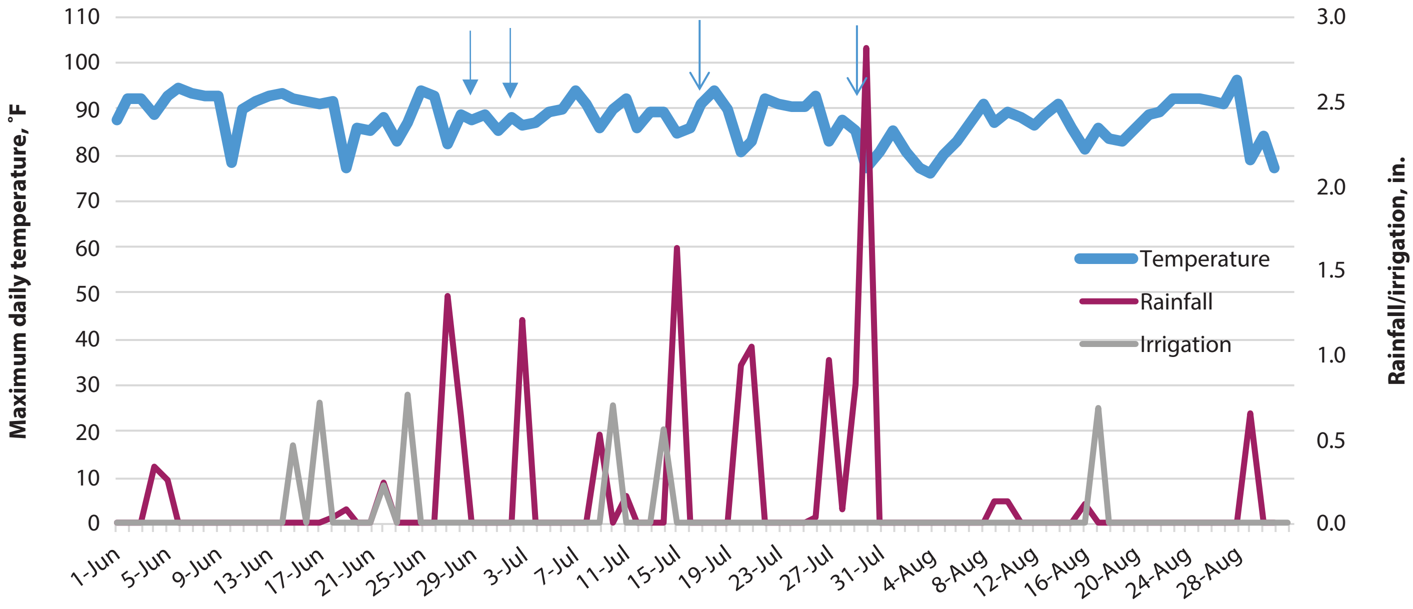

Figure 6. Daily maximum temperatures, daily rainfall and irrigation at the Kansas River Valley Experiment Field, Topeka, in 2020. Arrows indicate tasseling for successive planting dates.

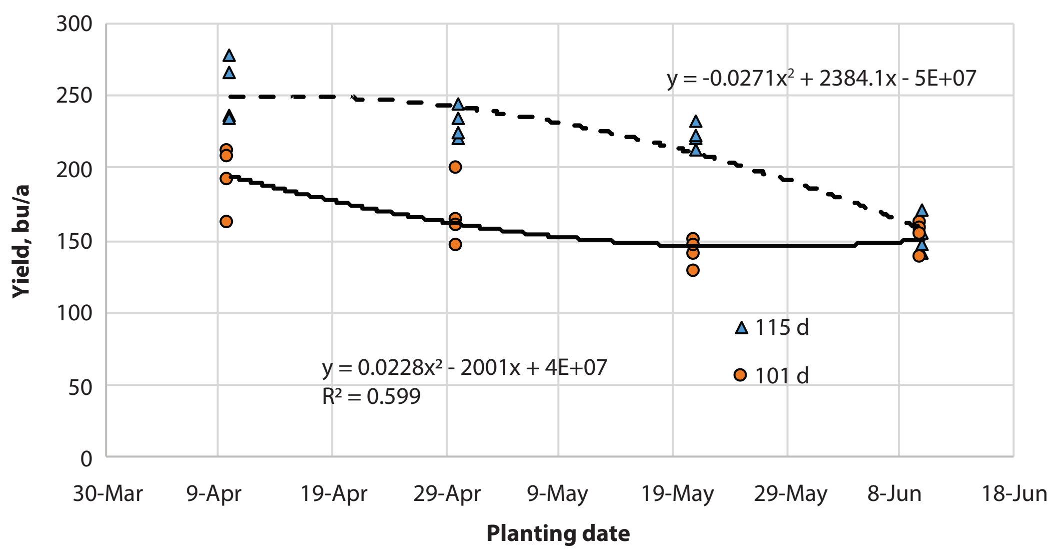

Figure 7. Yield response of short and full season corn under irrigation to planting date at the Kansas River Valley Experiment Field, Topeka, in 2020.