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# Effect of Late Planting Dates on Corn Yield

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## Abstract

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 second week of June until even the 4th week can yield from 50 to 70% of the highest yield of the earlier planting dates.



## Keywords

corn, planting date, late planting

# 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 second 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, 2020, and 2021. The experiment at Topeka was irrigated with irrigations totaling 9.5 inches applied June 8 through August 13, 2018; 3.5 inches from June 30 through July 30, 2019; 4.1 inches from June 15 through August 17, 2020; 6.45 inches from June 14 to August 25, 2021. An overhead sprinkler irrigation system 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; April 10 to June 10 at Topeka and April 8 to June 8 at Ottawa in 2020; and April 6 to June 10 at Topeka and from April 5 to June 23 at Ottawa in 2021. 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. In 2021, DK 51-91 (101 RM) and DK 65-95 (115 RM) were planted at Ottawa, and Integra 5081 (100 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-

to 40-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

In 2018, the growing season started off cool, with seedlings from the first planting date taking more than 16 days to emerge, but the weather warmed up quickly. Seedlings from the second planting date emerged approximately 3 days after the first planting date emerged. The rest of the growing season continued to be warmer than average, with below-average rainfall during April through July. Although temperatures remained high in August, rainfall exceeded the 30-year average.

In 2019, there was a cool period in early May, then temperatures were closer to average for June and July, with August being 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 the 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.

In 2021, similar to 2020, there were cool/cold periods in April and May, with snow on April 20, that slowed corn emergence in the earlier planted corn. The days to emergence at Topeka were 20, 14, 7, and 4 days, respectively, for the earliest to the latest planting dates. At Ottawa, the day to emergence were 35, 14, 7, and 8 days for 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 the corn planted in early to mid-May was trying to pollinate. 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 (Tables 1, 2). 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 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 3). 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.

In 2021, the highest corn yield at Ottawa was with the early April planting of the full season hybrid, similar to 2020 (Table 4). The next highest yield was with the short

season hybrid planted the first part of June, very different from the previous years. In contrast, the lowest yield was with the short season hybrid planted in early April. The June 23 planting experienced hot/dry conditions shortly after planting, resulting in crusting issues with very few plants emerging (data not shown), therefore, the data from that planting date were not included in the results.

For all years at Topeka, the yield-limiting factor of moisture stress was greatly reduced by repeated irrigations, resulting in a more traditional yield response to planting date (Tables 5-8). The highest yield was when corn was planted in the last half of April in 2018 and 2019 (Tables 5, 6). In 2020, the highest yield was with the April 10 planting date for both the short and full season hybrids (Table 7). The full and shorter season hybrids' yields were almost equal when planted June 11. Similar to 2020, the highest yield in 2021 at Topeka, was with the full season hybrid planted in early April (Table 8). The short season hybrid planted early had the lowest yield, similar to results from Ottawa this year. Both hybrids planted in early June averaged 70% of high yield for the study.

Generally, grain test weights were lower with the last planting dates at both locations for all years, especially with the full season hybrid (Tables 1–8). This reduction in grain test weight was related to the shorter grain fill period for the later planting dates.

Overall, the planting date for the highest yield at Ottawa varies, depending on the environment experienced that year (Figure 1). With irrigation to help reduce some of the variability at Topeka, the highest yield tended to be with the earlier planting dates (Figure 2). Planting corn in June at Ottawa generally yielded 70% of the highest yield, and the June planting at Topeka generally averaged 60%.

Switching from a full to a shorter season hybrid due to delayed planting generally did not increase yield at either location. However, the shorter season hybrid may not take as long to mature and dry down at harvest (Tables 1–8).

The preliminary results from four 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.

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**Table 1. Effect of planting date on dryland corn at the East Central Kansas Experiment Field, Ottawa, in 2018**

| Planting date | Grain moisture | Grain test weight | Grain yield | Percent high yield |
|---|---|---|---|---|
| | % | lb/bu | bu/a | % |
| 13-Apr | 15.3 d† | 62.0 a | 98 a | 88 ab |
| 30-Apr | 15.6 d | 62.9 a | 93 ab | 83 ab |
| 18-May | 18.8 b | 60.7 b | 60 bc | 52 c |
| 8-Jun | 18.0 c | 58.8 c | 96 a | 86 ab |
| 29-Jun | 23.7 a | 52.5 d | 66 bc | 60 bc |
| Pr>F | <0.0001 | <0.0001 | 0.05 | 0.046 |

†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 2019**

| Planting date | Grain moisture | Grain test weight | Grain yield | Percent high yield |
|---|---|---|---|---|
| | % | lb/bu | bu/a | % |
| 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 |

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

**Table 3. 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 d | 49 d |
| 28-Apr | 101 | 26935 | 16.1 e | 55.5 ab | 136 bc | 74 bc |
| 18-May | 101 | 26862 | 17.5 d | 55.2 a | 146 b | 79 b |
| 8-Jun | 101 | 26499 | 23.8 b | 50.0 d | 128 c | 69 c |
| | | | | | | |
| 8-Apr | 114 | 27007 | 17.5 d | 56.3 a | 153 b | 83 b |
| 28-Apr | 114 | 27080 | 18.3 d | 56.5 ab | 180 a | 98 a |
| 18-May | 114 | 27080 | 19.6 c | 55.3 ab | 179 a | 97 a |
| 8-Jun | 114 | 27806 | 25.0 a | 50.6 d | 140 bc | 76 bc |
| Pr>F | | 0.61 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |

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

**Table 4. Effect of planting date on dryland corn at the East Central Kansas Experiment Field, Ottawa, in 2021**

| Planting date | Hybrid rel. mat. | Plant pop. | Grain moisture | Grain test weight | Grain yield | Percent high yield |
|---|---|---|---|---|---|---|
| | days | plants/a | % | lb/bu | bu/a | % |
| 5-Apr | 102 | 25615 | 15.4 cd† | 57.0 a | 117 c | 63 c |
| 26-Apr | 102 | 25263 | 14.5 d | 57.6 a | 131 bc | 70 bc |
| 4-June | 102 | 27085 | 17.9 bc | 57.5 a | 163 ab | 88 ab |
| | | | | | | |
| 8-Apr | 115 | 25840 | 16.6 bcd | 58.4 a | 186 a | 100 a |
| 28-Apr | 115 | 21345 | 19.0 b | 57.3 a | 151 b | 81 b |
| 4-June | 115 | 24975 | 25.1 a | 53.9 b | 135 bc | 72 bc |
| Pr>F | | 0.14 | <0.0001 | 0.007 | 0.004 | 0.003 |

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

**Table 5. Effect of planting date on corn under irrigation at Kansas River Valley Experiment Field, Topeka, in 2018**

| Planting date | Plant pop. | Grain moisture | Grain test weight | Grain yield | Percent high yield |
|---|---|---|---|---|---|
| | plants/a | % | lb/bu | bu/a | % |
| 10-April | 30750 | 17.1 b† | 62.1 ab | 215 a | 84 a |
| 23-April | 30500 | 17.4 b | 62.3 a | 240 a | 94 a |
| 18-May | 30375 | 17.0 b | 61.3 b | 219 a | 85 a |
| 11-June | 27875 | 25.6 a | 52.3 c | 127 b | 50 b |
| Pr>F | 0.25 | <0.0001 | <0.0001 | 0.0050 | 0.003 |

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

**Table 6. Effect of planting date on corn under irrigation at the Kansas River Valley Experiment, Field, Topeka, in 2019**

| Planting date | Plant pop. | 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 |

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

**Table 7. Effect of planting date on irrigated corn at the Kansas River Valley Experiment Field, Topeka, 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 | 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 $\alpha = 0.05$.

**Table 8. Effect of planting date on irrigated corn at the Kansas River Valley Experiment Field, Topeka, in 2021**

| 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 | 100 | 35149 | 11.7 d | 52.7 | 119 c | 49 c |
| 30-Apr | 100 | 35501 | 12.3 cd | 55.6 | 166 b | 67 b |
| 21-May | 100 | 35000 | 14.5 bcd | 54.4 | 185 b | 75 b |
| 10-Jun | 100 | 35625 | 19.2 b | 55.6 | 166 b | 66 b |
| | | | | | | |
| 8-Apr | 115 | 34630 | 17.4 bc | 56.6 | 247 a | 100 a |
| 30-Apr | 115 | 35697 | 18.4 b | 58.3 | 239 a | 95 a |
| 21-May | 115 | 35125 | 17.6 bc | 56.9 | 231 b | 95 a |
| 10-Jun | 115 | 36875 | 25.9 a | 56.1 | 180 b | 75 b |
| Pr>F | | 0.25 | 0.0005 | 0.18 | <0.0001 | <0.0001 |

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

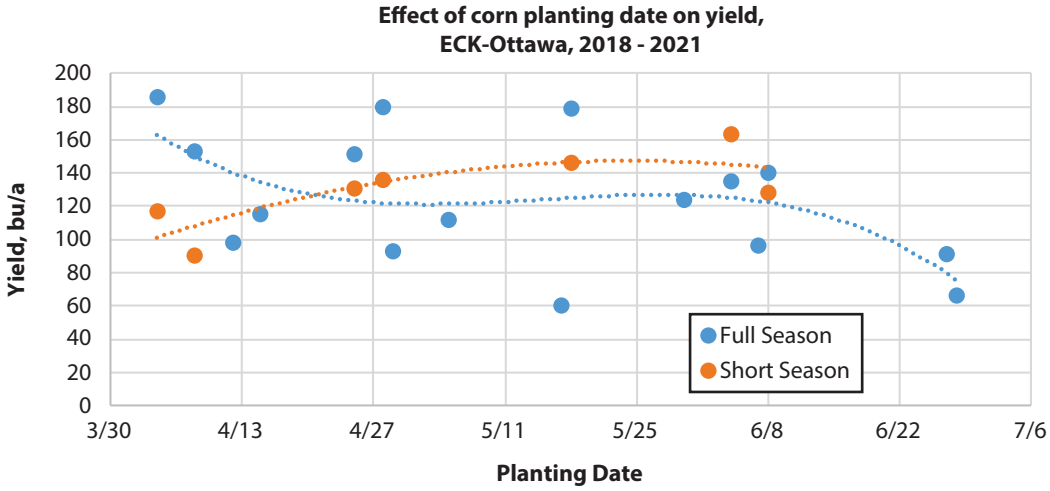


**Figure 1. Effect of corn planting date on yield averages at East Central Kansas Experiment Field, Ottawa, 2018–2021.**

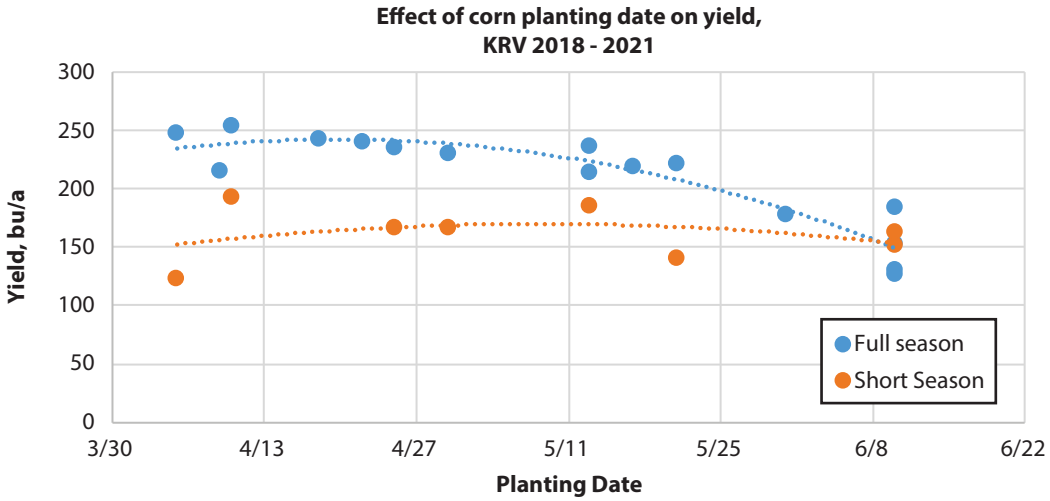


**Figure 2. Effect of corn planting date on yield averages at Kansas River Valley Kansas Experiment Field, Topeka, 2018–2021.**