



What Do We Know About Planting Dates and Corn and Soybean Yield from Agronomic Field Trials?

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The impact of planting date on projections of corn and soybean yield is always an important issue at this time of year. The latest weekly *Crop Progress* report from the USDA indicates that only two percent of the 2022 U.S. corn crop was planted as of April 10th. While this is only slightly less than the five-year average for this week, the concern is that cold and wet conditions in much of the U.S. Corn Belt will cause planting progress to fall behind the normal pace, and this will in turn reduce yield potential. The purpose of this article is to review what is known from agronomic field trials about optimal planting dates for corn and soybeans in Illinois.

Analysis

As discussed in earlier *farmdoc daily* articles ([May 13, 2020](#); [May 20, 2020](#)), there are different approaches to assess the impact of planting date on state or national corn and soybean yields. It safe to say that the starting point in all discussions on this subject should be the results of agronomic field trials. Rigorous experimental methods are applied in these field trials to determine planting date impacts. Alternative planting dates are used in the same locations with the same varieties and management practices to isolate the impact of planting date on yield. Multiple locations and years provide the necessary sample size to draw reliable conclusions.

Here at the University of Illinois, Professor Emeritus Emerson Nafziger has been conducting planting date field trials for corn and soybeans for many years (e.g., [Nafziger, 2020](#)). He shared updated results for this article, for which we are grateful. It is typical of the information generated from agronomic research relating planting date to corn and soybean yields. The trial results are presented in Figures 1 and 2 and Table 1. The observations for corn are drawn from four central and northern Illinois sites over 2007 through 2021. The observations for soybeans are drawn from six southern, central and northern Illinois sites over 2010 through 2020. Figures 1 and 2 contain the individual site observations as well as an estimated planting date response curve. Note that yield in these two plots is expressed as a percentage of the maximum yield for all planting dates at a location in a given year. This normalizes the observations for different yield levels across years. Table 1 presents a side-by-side comparison of planting date

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impacts on corn and soybean yield in terms of a yield penalty. The cumulative yield loss by a given date is presented in both percentage and bushel terms.

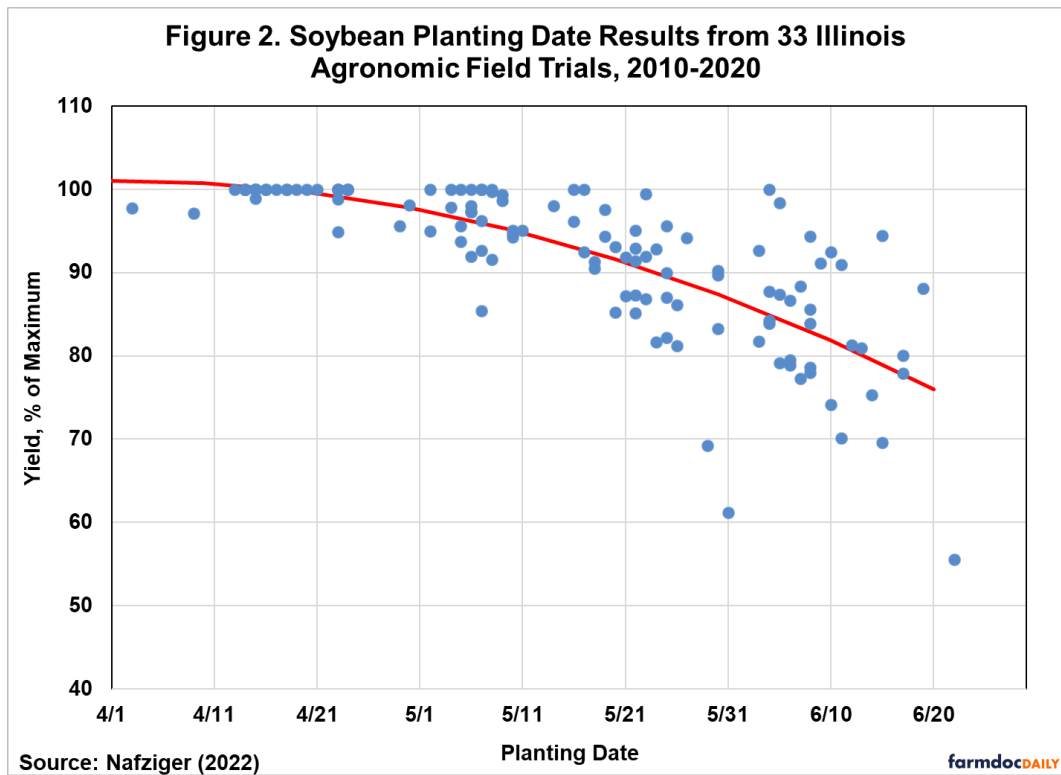
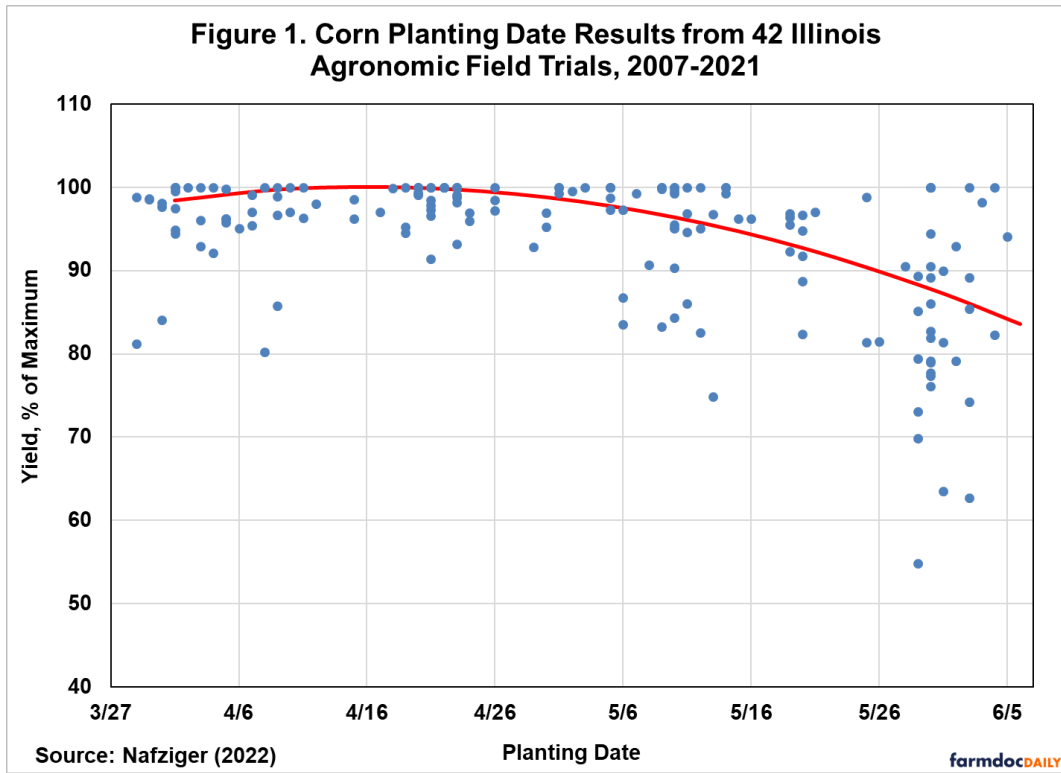


Table 1. Comparison of Results from Corn and Soybean Planting Date Agronomic Field Trials in Illinois, 2007 - 2021

Planting	Cumulative Yield Loss by Date			
	Corn	Soybeans	Corn	Soybeans
	---percent---		---bushels---	
4/1	2		3	
4/10	0	0	0	0
4/20	0	2	0	1
4/30	1	4	3	2
5/10	4	6	8	4
5/20	8	10	17	7
5/30	13	14	28	10
6/10	16	19	35	13
6/20		25		17

Notes: The sample for the corn results is 2007- 2021 and 2010 - 2020 for soybeans. The planting date listed for the corn observations listed on the row for 6/10 is actually 6/5. The original source for the results is Nafziger (2022).

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Takeaways:

#1. The optimal planting window is relatively wide.

Figures 1 and 2 show that the optimal planting date to maximize corn and soybean yield in Illinois is mid- to late-April. However, yield losses a couple of weeks on either side of the optimal window are relatively modest. This is another way of saying that the planting date response curves for corn and soybeans are basically flat from early April to early May. Practically speaking, this means there is roughly a four-week optimal window for planting corn and soybeans in Illinois.

#2. The optimal planting window for corn and soybeans is similar.

This point is implied by the discussion in #1 above. However, this is such an important result that it should be highlighted on its own. The fact that the optimal planting window is similar for corn and soybeans upends the old rule-of-thumb for decades that farmers in Illinois should plant corn first and soybeans second. This actually compresses the combined planting window for corn and soybeans and raises the question of how much farmers should invest in planting capacity to plant corn and soybeans in the same window.

#3. Substantial yield penalties for late planting do not begin until mid-May.

Table 1 shows that as late as May 10th the yield penalty for planting date is only four percent for corn and six percent for soybeans. This is eight bushels per acre on corn and four bushels on soybeans. However, yield penalties increase quickly once the calendar passes May 10th. By May 30th, the yield penalty for late planting increases by two to three times in magnitude.

#4. The yield penalty for very late planting can be quite large.

Planting corn and soybeans in June may result in large reductions in yield for both corn and soybeans. Early to mid-June planting can lead to yield losses as large as 20-25 percent. This reflects

compression of the growing season, which reduces the time for grain fill, as well as pushing maturity closer if not past first frost and freeze dates. The lost revenue can be surprisingly large in these cases. For example, the estimated 35 bushel loss in corn yield for planting on June 5th (listed as June 10th in the table) is \$175 per acre at \$5 per bushel.

#5. The response of yield to planting date is inherently uncertain, especially for very late planting.

Figures 1 and 2 show a notable range of data observations for most planting dates for both corn and soybeans. It is interesting that the only obvious exception is for planting soybeans in early to mid-April. Otherwise, the spread of the data points on a given date is generally at least 10 percentage points. The spread increases dramatically the later the planting date. As an example, the lowest observation for corn on June 2nd is 62.7 percent and the highest is 100 percent. The lesson is that planting very late can still result in good yields if everything goes just right the rest of the season, but if conditions are less than ideal then things can go very wrong.

It is important to emphasize that the field trial results on planting date reviewed here strictly apply only to Illinois. Results from corn and soybean planting date research for different years and different locations throughout the Corn Belt vary somewhat, but the reported pattern of yield response to planting date is comparable to those presented here. Examples of other research in this regard include Abendroth et al. (2017) and Long et al. (2017).

Implications

Agronomic field trials provide the foundation for any discussion of planting date impacts on corn and soybean yield. We reviewed over 20 years of field trial results from Illinois in this article. These trials were conducted by Professor Emeritus Emerson Nafziger of the University of Illinois. Key takeaways are that: 1) the optimal planting window is relatively wide; 2) the optimal planting window for corn and soybeans is similar; 3) substantial yield penalties for late planting do not begin until mid-May; 4) the yield penalty for very late planting can be quite large; and 5) the response of yield to planting date is inherently uncertain, especially for very late planting. An important implication is that the 2022 corn and soybean crops can still be planted in a timely manner given that the optimal planting window does not end until roughly mid-May. Of course, this will depend on weather conditions over the next month and the speed with which corn and soybean planting can progress. We will review what we know about corn and soybean planting speed in an article next week.

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