Cold Front Planting Timing – Corn

Amanda Douridas, Ohio State University Extension Educator, Madison County

Published: May 2024

Objective

Determine how planting timing prior to, during, or after a cold front impacts corn yield.

Background

Cold fronts can affect corn production in the Midwest and Ohio. This project came about to investigate which planting condition changes may impact yield and inform farmers on when they should stop planting prior to a predicted cold front. The concern is imbibition of cold water by the seed which can cause chilling injury. Imbibition is the rapid uptake of water from the soil. This typically occurs within 24 hours after planting. Cal and Obendorf (1972) reported sensitivity to corn when imbibing water at 41ºF (5°C) in the first 24 hours, otherwise known as seed chilling injury. If the seed imbibed warm water in the first 24 hours, no injury was seen. Today, the consensus is that chilling injury is more likely to occur at soil temperatures below 50°F (Lindsey, 2022).

This project was conducted in 2023 at the Western Agricultural Research Station in Clark County near South Charleston, Ohio. The soil type was Strawn Crosby and the field had tile every 40 feet. The previous crop was soybeans and the tillage type was no-till. The seeding rate was 34,000 seeds per acre. The plots were harvested on November 1, 2023.

Hypothesis: Planting the day of the cold front will reduce yields due to seed chilling injury.

Methods

Planting occurred in relation to a predicted cold front in the area. Cold fronts (a warm air mass replaced by a cooler air mass) with precipitation were our target. Treatments included 1) planting three days prior to a cold front, 2) planting two days prior, 3) planting one day prior, 4) planting the day of the cold front, 5) planting the first suitable day after, and 6) planting two weeks after the cold front date. Soils were allowed to warm first in the spring to at least 55°F before initiating planting to ensure the 3-, 2- and 1-day prior treatments were planted into soil conditions above where past research has shown injury. Each treatment was replicated four times and laid out in a randomized complete block design (RCBD). Analysis of variance (ANOVA) was used for comparing yields between treatments and treatment means were separated using Fisher's Protected LSD Test (alpha = .1). Soil temperature information at the 2-inch depth was collected from the weather station at the farm. Tables 1 to 3 summarize treatments, planting dates, soil temperatures, stand counts, and yield results.

Plot Layout

Plot #	401	402	403	404	405	406
Treatment Code	4	1	6	2	5	3
Plot #	301	302	303	304	305	306
Treatment Code	2	6	1	5	3	4
Plot #	201	202	203	204	205	206
Treatment Code	5	1	4	2	6	3
Plot #	101	102	103	104	105	106
Treatment Code	3	5	2	1	4	6

Treatment Code Key	
1	3 days prior
2	2 days prior
3	1 day prior
4	Day of cold front
5	1st day suitable after
6	2 weeks after

Table 1. Treatment List and Planting Dates for the 2023 season.

Treatment	**Planting Date**
Cold Front 1, 3 days prior	4/19/2023
Cold Front 1, 2 days prior	4/20/2023
Cold Front 1, 1 day prior	4/21/2023
Cold Front 1, day of cold front	Rained out
Cold Front 1, first day fit	4/27/2023
Cold Front 1, 2 weeks after	5/11/2023

Results

Corn yields ranged from 251 to 263 bushels per acre (Table 2). The yield differences in treatments were not statistically significant (indicated by the LSD and 'A' next to yields in Table 2). Average soil temperatures at 2-inches deep the day of each planting date were all above 50°F, which is the proposed threshold to avoid seedling damage in corn.

Cold front severity is difficult to predict. This cold front was predicted for 4/22/2023. The day of the cold front was rained out, so we were unable to plant that treatment. The 5/11 planting date was consistently one growth stage behind the other treatments all season. The average 2-inch soil temperature on 4/19 was 53.6° F and rose to 57° F over the next two days then dropped to 51.8° F by 4/23 (Table 3). Soil temperatures at the 2-inch depth for the end of April to early May ranged from 49.2 to 61.7°F; conditions which are proposed safe for corn growth and development.

The earliest planting dates were still at VE on 5/10 which led to a difference of only one growth stage at V3 (3 developed leaves with collar). Stands, confirmed by stand counts at V3, was fairly consistent across all treatments but planting two days ahead of the cold front (4/20) did result in a significantly higher stand count than all other plantings except the two weeks after which had comparable stands to 2 days prior cold front planting (Table 2).

Table 2. Corn Yield Response, Stand Counts, and Sil Temperatures for Planting Dates Prior, During, and After the Cold Front in the 2023 crop season.

Treatment (plant date)	Yield Avg (bushels/acre)	Stand Count Avg (1,000 plants per acre)	Avg Daily Soil Temp, 2" (°F)
3 days prior to (4/19)	251 A	30.9 B	53.6
2 days prior to (4/20)	250 A	32.5 A	57.0
1 day prior to (4/21)	263 A	30.9 B	57.2
Day of (n/a)	n/a	n/a	55.6
First suitable after (4/27)	254 A	30.4 B	53.6
2 weeks after (5/11)	251 A	31.8 AB	62.9
	LSD (0.1) 9.7	LSD (0.1) 1.5	

Table 3. Avg Daily Soil Temperatures at 2-inch Depths Between Planting Dates

Date	Avg Daily Soil Temp, 2" (°F)	Date	Avg Daily Soil Temp, 2" (°F)
4/23/2023	51.8	5/3/2023	51.4
4/24/2023	50.9	5/4/2023	52.7
4/25/2023	49.2	5/5/2023	55.2
4/26/2023	52.5	5/6/2023	57.2
4/28/2023	55.6	5/7/2023	60.3
4/29/2023	56.4	5/8/2023	62.2
4/30/2023	56.7	5/9/2023	63.4
5/1/2023	52.7	5/10/2023	61.7
5/2/2023	50.6		

Summary

The yield differences in treatments were not statistically significant. By not being able to plant the day of the cold front, and having no statistical significance in yield, this study suggests there is no yield penalty for planting 1-3 days ahead of a cold front or waiting until after with these planting dates under these conditions. The 2-inch soil temperature did not drop below 50°F until 4 days after the last planting date ahead of the cold front (minimum drop), revealing the impacts from this cold front to be less severe than predicted. These results can change if temperatures below 50°F occur closer to the planting date.

The author has written reports with this same protocol in prior years (2022) which are available on agcrops.osu.edu/on-farm-research.

Acknowledgements

The authors express appreciation to Joe Davlin and the Western Agricultural Research Station team for conducting the field operations.

For more information, contact:
Amanda Douridas
OSU Extension – Madison County
217 Elm St.
London, Ohio 43140
Douridas.9@osu.edu

References

Cal, J.P. and Obendorf, R.L. (1972), Imbibitional Chilling Injury in *Zea mays* L. Altered by Initial Kernel Moisture and Maternal Parent1. Crop Science, 12: 369-373 cropsci1972.0011183X001200030034x. https://doi.org/10.2135/cropsci1972.0011183X001200030034x

Lindsey, A., Lindsey, L., Ortez, O. (2022) *Imbibitional Chilling – Is it a concern?* C.O.R.N. Newsletter 2022-11. https://agcrops.osu.edu/newsletter/corn-newsletter/2022-11/imbibitional-chilling-%E2%80%93-it-concern