

8-19-2013

Late-season Corn Development and Frost Probabilities

Roger W. Elmore

Iowa State University, relmore@iastate.edu

Follow this and additional works at: <http://lib.dr.iastate.edu/cropnews>

 Part of the [Agricultural Science Commons](#), [Agriculture Commons](#), and the [Meteorology Commons](#)

Recommended Citation

Elmore, Roger W., "Late-season Corn Development and Frost Probabilities" (2013). *Integrated Crop Management News*. 56.
<http://lib.dr.iastate.edu/cropnews/56>

The Iowa State University Digital Repository provides access to Integrated Crop Management News for historical purposes only. Users are hereby notified that the content may be inaccurate, out of date, incomplete and/or may not meet the needs and requirements of the user. Users should make their own assessment of the information and whether it is suitable for their intended purpose. For current information on integrated crop management from Iowa State University Extension and Outreach, please visit <https://crops.extension.iastate.edu/>.

Late-season Corn Development and Frost Probabilities

Abstract

Cool August temperatures across Iowa slow growing degree day (GDD) accumulations. In addition, Iowa's late corn planting dates this year obviously impacted the crop as well. These two factors affect corn yield potential.

Keywords

Agronomy

Disciplines

Agricultural Science | Agriculture | Meteorology

[ICM Home](#)[ISU Extension Calendar](#)[Publications](#)[Extension News](#)[County Offices](#)[Contact Us](#)
[Subscribe to Crop News](#)

Archives

[2014](#)[2013](#)[2012](#)[2011](#)[2010](#)[2009](#)[2008](#)[Previous Years](#)

ISU Crop Resources

[Extension Field Agronomists](#)[Crop & Soils Info](#)[Pesticide Applicator Training](#)[Agronomy Extension](#)[Entomology Extension](#)[Plant Pathology Extension](#)[Ag and Biosystems Engineering Extension](#)[Agribusiness Education Program](#)[Iowa Grain Quality Initiative](#)[College of Agriculture and Life Sciences](#)[ISU Extension](#)

Integrated Crop Management NEWS

[PRINT STORY](#)
[EMAIL STORY](#)
[ADD TO DELICIOUS](#)
[ATOM FEED](#)
[FOLLOW ON TWITTER](#)

Late-season Corn Development and Frost Probabilities

By Roger Elmore, Department of Agronomy

Cool August temperatures across Iowa slow growing degree day (GDD) accumulations. In addition, Iowa's late corn planting dates this year obviously impacted the crop as well. These two factors affect corn yield potential.

I addressed GDD accumulations in a recent [CropWatch blog](#) posting. Growing degree day accumulations clearly lag behind normal. Cool temperatures after silking not only slow GDD accumulation, thus slowing crop development, but also can increase yield potential given specific conditions. The record yields of 2009 resulted from slow GDD accumulation after silking coupled with a late frost. On the other hand, warm temperatures after silking in 2010 reduced corn yield potential (See an [ICMNews](#) article reporting this).

Earlier this season I addressed the potential impact of late corn planting on yields; see [Crop Model Output](#) and [Field Research Data](#). The August 12th USDA yield forecast in part reflects this; Iowa's [USDA August forecast yield](#) of 163 bushels per acre is almost 9 percent below 30-year trend-line yields (10 percent below the 30-year trend is "officially" drought).

Dry matter accumulation and grain moisture during reproductive stages

Let's address another question here: Will the corn crop mature before frost? My response to this question depends on when the first 28°F or colder frost occurs and the crop's current development stage. Table 1 presents a timeline of corn development as well as kernel dry matter and moisture content during dent – R5. Physiological maturity (R6) is the point when maximum kernel dry matter occurs – normally around 35 percent grain moisture. Black layer formation occurs a bit later than R6, typically 28 percent ± 4 percent. Contrary to popular thinking, kernels do not lose dry matter after R6.

Reproductive stages	Days from R1 (Silk)	Variables after R5 (Dent)			
		Grain moisture %‡	Kernel dry weight (% of total)‡	Time between R5 stages	
				GDD§	Days
R1 (Silk)	0				
R2 (Blister)	10 to 12				
R3 (Milk)	18 to 20				
R4 (Dough)	24 to 26				
R5 (Dent)	31 to 33	60	45	75	3
¼ milk¶	34 to 36	52	68	120	6
½ milk	40 to 42	40	90	175	10
¾ milk	50 to 52	37	97	205	14
R6 (Mature)	64 to 66	35	100		

† Information in this table is adapted from: Abendroth et. al. 2011. *Corn growth & development*. Iowa State Univ. Extension & Outreach. PMR 1009. Available at: [http://www.extension.iastate.edu/corn/abendroth-et-al-2011-corn-growth-development](#)

‡ Grain moisture and dry matter can vary ±2% except dry matter at R6 is always 100%.

§ GDD = Growing degree day units, 86/50 method is standard for corn.

¶ The 'milk line' separates the softer milky-white portion nearest the cob and the starchy solid portion at the top. The milk line moves from the top of the kernel toward the cob as the kernel matures.

[Full-size table](#)

Based on data in Table 1, corn in early dent (R5) has about 60 percent grain moisture, accumulated about 45 percent of its dry matter, and needs another 33 days to mature. At three-quarter milk line, 97 percent of the dry matter is accumulated and it will take about two weeks to mature.

Freeze dates

Figure 1 shows the most recent 30-year dates for median first fall 28°F frost across the Midwest. The median date for portions of NW and NE Iowa ranges from October 1 to 10; that for SE IA range from October 21 to 30. The median first fall 28°F frost for rest of the state ranges between October 11th and 20th (from [MRCC](#)).

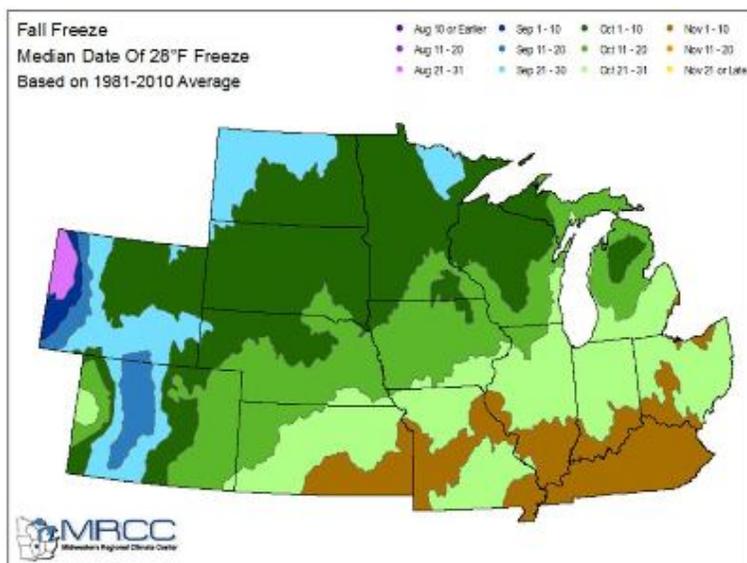


Figure 1. Median fall 28°F freeze dates based on 1981-2010 averages. From [MRCC](#). [Full-size image](#)

Mesonet provides [tables of probabilities by specific locations](#) for fall frost events with different temperature thresholds. These data are averages since

1951. Figures 2, 3, and 4, display probabilities of temperatures less than 29°F for Iowa's nine [crop reporting districts](#). For example: for SW Iowa (fig 2) the average date of the first hard freeze is Oct. 21. In addition, one year in five the freeze may be later than Oct. 28, and one year in 10 it may be Nov. 4 or later. On the other hand, note that one year in 10 the hard freeze is on or before Oct. 5.

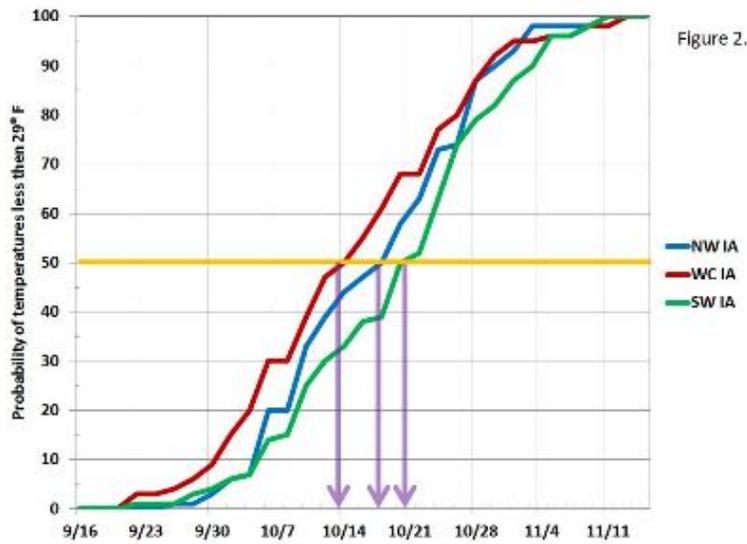


Figure 2. Probability of temperatures less than 29°F for NW, WC & SW Iowa. The horizontal yellow line marks 50 percent probability. The vertical light purple lines point to the dates of the 50 percent probability of temperatures less than 29°F temperatures for each of the three Crop Reporting Districts. Data from [Mesonet](#). [Full-size image](#)

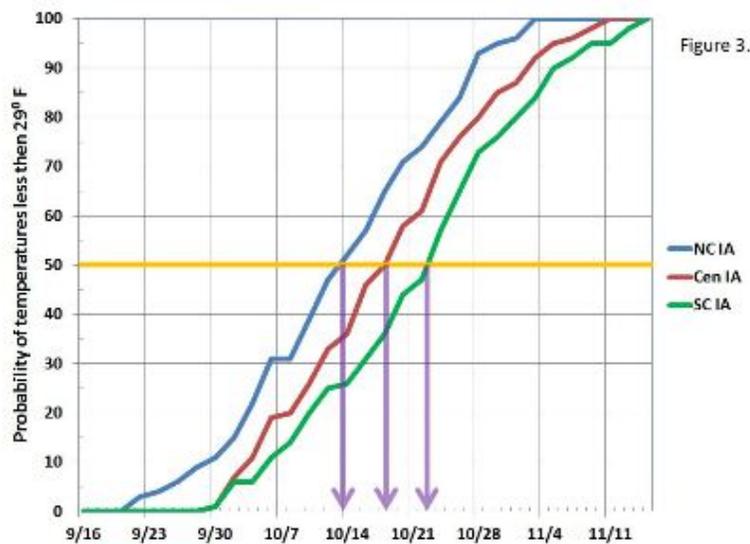


Figure 3. Probability of temperatures less than 29°F for NC, Central & SC Iowa. The horizontal yellow line marks 50 percent probability. The vertical light purple lines point to the dates of the 50 percent probability of temperatures less than 29°F temperatures for each of the three Crop Reporting Districts. Data from [Mesonet](#). [Full-size image](#)

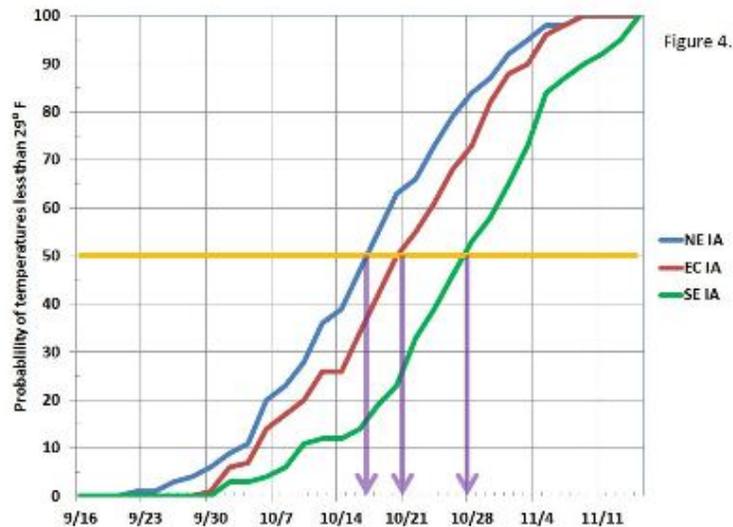


Figure 4. Probability of temperatures less than 29°F for NE, EC & SE Iowa. The horizontal yellow line marks 50 percent probability. The vertical light purple lines point to the dates of the 50 percent probability of temperatures less than 29°F temperatures for each of the three Crop Reporting Districts. Data from [Mesonet](#). [Full-size image](#)

The date with 50 percent probability of less than 29°F temperatures ranges with northern CRD's occurring earlier than the southern CRD's – a range of 9 to 12 days earlier in the north in the three central and eastern-most CRDs. The northwest CRD has later frost dates than the west central CRD.

Fifty percent probability dates of temperatures below 29°F for the western parts of the central and southern CRD's arrive six days earlier than the eastern parts of those regions. Those dates vary little across northern Iowa CRDs, October 14 to 18.

Warmer temperatures in the current short-term forecast may help accumulate GDDs faster. However, much of the state remains dry (see [drought monitor](#)). Warmer temperatures with dry conditions will stress the crop even more.

The critical issue of this whole season is the timing of the first 28° F frost this fall. A later than normal frost encourages longer seed-fill period and higher yields. An early frost ... well let's hope it doesn't happen!

Roger Elmore is a professor of agronomy with research and extension responsibilities in corn production. He can be contacted by e-mail at relmore@iastate.edu or (515) 294-6655.

This article was published originally on 8/19/2013 The information contained within the article may or may not be up to date depending on when you are accessing the information.

Links to this material are strongly encouraged. This article may be republished without further permission if it is published as written and includes credit to the author, Integrated Crop Management News and Iowa State University Extension. Prior permission from the author is required if this article is republished in any other manner.