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2012 Corn Crop Races to Maturity: Impacts on Grain-fill Period and Yield

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Abstract
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2012 Corn Crop Races to Maturity: Impacts on Grain-fill Period and Yield

By Roger Elmore, Department of Agronomy

Iowa's 2012 corn crop races through development stages because of rapid Growing Degree Day (GDD) accumulation (see Table 1 and August 3 ICM News). High minimum daily temperatures largely contributed to the abnormal GDD accumulations. Many wonder and ask how the GDD accumulation rates affect not only maturity but also yield.

Growing Degree Day accumulations outpace norm

On average, GDD accumulated 15 to 16 percent ahead of normal across the state since May 1 and during the month of July (Table 1). Because temperature drives corn development, higher heat unit accumulation means faster cycling through development stages and earlier maturing crops.

Table 1. Iowa 2012 Growing Degree Days (GDD), Base 50 - Ceiling 86†

Iowa		May 1 to July 31		July 1 to July 31		July 27 to Aug. 2	
Region	Cropping district	2012 GDD	Percent of normal	2012 GDD	Percent of normal	2012 GDD	Percent of normal
NW	1	1911	118	816	119	165	113
NC	2	1871	115	797	117	157	109
NE	3	1884	118	807	119	163	113
WC	4	1951	113	823	113	172	111
C	5	1938	115	817	115	166	111
EC	6	1993	116	842	116	176	114
SW	7	2070	115	852	114	183	113
SC	8	2016	114	850	114	179	112
SE	9	2035	112	857	113	182	112
State		1957	115	827	116	171	112

† Data from Midwest Regional Climate Center

Table 1.

During the week of July 27 to August 2, corn accumulated 171 GDD, 12 percent ahead of normal for the week. State average GDD accumulation sits

at 1,957 GDD. Looking ahead, if temperatures continue as they were that week, accumulating 24.4 GDD per day, a 2,600 GDD hybrid could mature in 26 days, i.e. August 26 ((2,600-1,957)/24.4). If, however, temperatures return to normal for the week July 27 – August 2 for the remainder of the month, 152 per week and 21.7 per day, the hybrid would mature four days later, August 30. Longer grain-fill period – silk to maturity - increases yield potential.

Historical crop development progress

In the August 3 ICM, I presented data showing the rapid pace of corn development in 2012 relative to last year and the five-year normal and the precipitous drop in crop conditions during July. In records going back to 1986, corn conditions in 2012 rank with 1988 (drought) and 1993 (floods).

Let's compare specific contrasting years – 1988 drought with yields 29 percent below trend line; 1992, with yields 14 percent above trend line; and 2004 yields, 13 percent above trend line. In terms of crop development, 1992 and 2004 contrast dramatically to those of 1988 (Table 2). Sixteen extra days for seed fill in both 1992 and 2004 dramatically increased yields. Compare these days from silking numbers with the averages for hybrids provided in the Iowa State University Extension and Outreach publication, Corn Growth and Development (Table 2).

Table 2. Estimates of average days for silking (R1) to dough (R4), dent (R5) and maturity (R6) in contrasting Iowa years compared to an average.

	Dough	Dent	Mature
Year	days from silking		
1988†	23	31	46
1992	33	46	62
2004	28	43	62
CGD‡	24 to 26	31 to 33	64 to 66

†1988 and 2004 data calculated from USDA-NASS Iowa data.
‡ CGD: Corn Growth and Development, ISU Extension & Outreach Publication PMR 1009.

Table 2.

Figures 1 to 4 show the USDA-NASS Iowa data graphically. The contrast between 1988, 1992 and 2004 is stark. The corn crop this year is developing faster than in the other years. Maturity will likely come sooner than any of these other years.

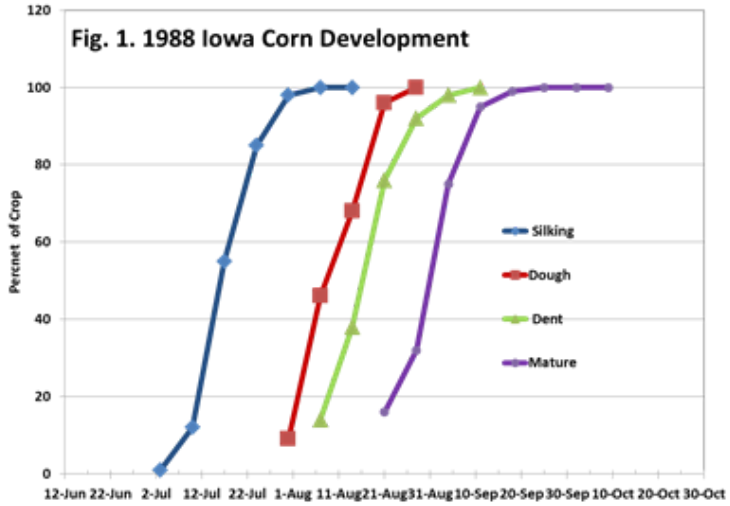

Figure 1.

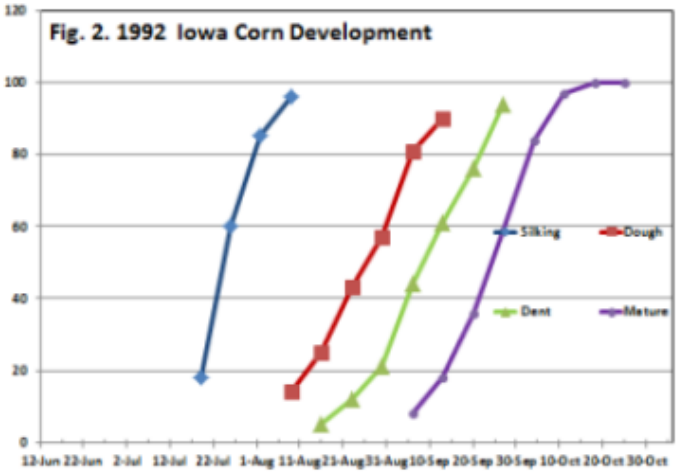

Figure 2.

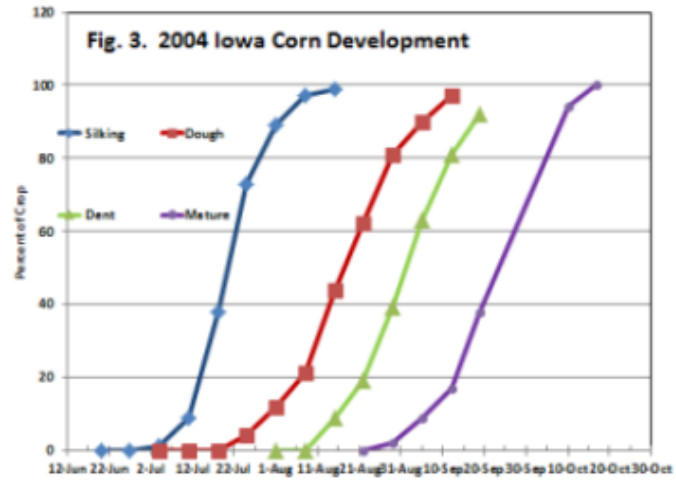

Figure 3.

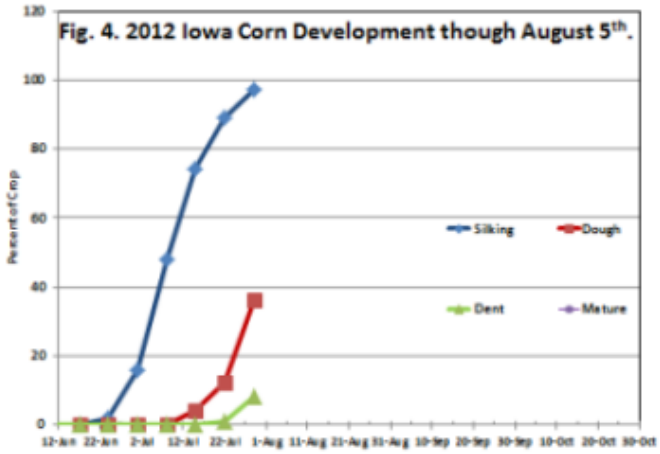

Figure 4.

Computer model simulations

Hybrid Maize model simulations at Crawfordsville in southeast Iowa show

that with a 2,600 GDD hybrid and a May 1 emergence date, grain-fill occurred over a 43-day period in 1988 and 68 days in 2004. According to the model, as of August 2, 2012 grain-fill period at Crawfordsville with the best possible weather occurring for the remainder of the year (like that of 2004), grain fill could take up to 53 days. That is far short of what would favor maximum yields (Table 2). With the worst possible weather we've seen recently (like that of 1988), grain fill might be as short as 41 days. That's less than we experienced statewide in 1988 (Table 2).

Trend lines of Hybrid Maize simulations for grain-fill days and yield at Crawfordsville and in central Iowa (Ames/Gilbert) have slopes that range between 1 and 3 percent per day. That suggests for every day grain-fill is extended, grain yield increases by 1 to 3 percent. Of course, it works in the opposite direction, too.

Cooler night temperatures could still help by increasing the grain-fill period in many of Iowa's corn fields. Likewise, plentiful rain could help retain some of the yield potential that still remains.

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