AGRONOMIC // UPDATE

Corn Maturity, Drydown, and GDU Accumulation

Kernel black layer signals corn kernel maturity. Kernel moisture content during the drying period is lost faster with warm, dry weather and slower with wet, cool weather.

What is black layer?

- Corn kernels reach physiological maturity when a black layer develops at the tip of a kernel (Figure 1).
- Kernel moisture content at black layer formation usually ranges from 25 to 40 percent, but averages around 30 percent.

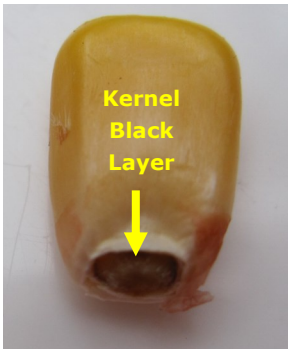

Figure 1. Black layer signals the end of kernel fill.

Factors influencing on grain maturity

- Grain maturity is influenced by an individual product's genetic relative maturity (RM) - shorter season products mature earlier than fuller season products.
- Environmental and agronomic issues can affect the timing of maturation. Severe drought or disease can cause products to die prematurely and form a premature black layer. Cool weather during the growing season can seemingly delay the maturation.

Corn growing degree day units

- Growing degree units are calculated by determining the mean daily temperature and subtracting that from the base (Tbase) temperature for corn growth (50° F). The upper limit for corn growth is 86° F. Seasonal GDU are determined by adding daily GDU together, starting on the date of planting.
- Table 1 provides GDU information for approximately 100 RM and 115 RM products.

Reproductive Growth Stages and Field Drydown

- Based on GDU accumulations, black layer and kernel moisture can be estimated. The kernel milk line can be used as a measure of kernel moisture content as the kernel advances toward black layer (Figure 2). Fully dented kernels require about 13 to 20 calendar days or 200 to 375 GDU (depending of product RM) to achieve black layer.[1, 2]
- Kernels begin their drying process after black layer formation; the environment has a great influence on the speed of moisture content loss. Warm, dry weather speed kernel drydown and wet and cool weather slow it. However, earlier maturing products will drydown faster than later maturing products regardless of weather.

Figure 2. The kernel milk line can be used as a measure toward black layer

- Typical drying rates after black layer range from 0.4% to 0.8% kernel moisture content loss per day.[1] Purdue University studies showed that a loss of 0.5% moisture content occurs when the mean accumulation of GDU is 12, and 0.75% moisture content is lost when the mean GDU accumulation is 22 per day (Table 2).[3]

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Product Characteristics Impacting Drydown

- **Thickness and Number of Husk Leaves.** Thinner and fewer husk leaves can promote quicker moisture content loss.
- **Husk Death.** Quicker death of husk leaves promotes quicker moisture content loss.
- **Ear Tip Exposure.** Exposed ear tips may provide for quicker grain moisture content loss (Figure 3).
- **Husk Tightness.** Husks that are loose and open may help increase grain drying.
- **Ear Angle.** Drooping ears tend to lose moisture content more quickly. Upright ears can capture moisture from rainfall (Figure 3).

Figure 3. Husk covered ear (L) and drooping, open husk (R).

- **Kernel Pericarp Properties.** Thinner pericarps (outer layer covering a corn kernel) have been associated with faster moisture content loss.

Maturity Calculators

Corn maturity calculators are available online from universities and other sources. By entering a location, planting date, and the GDU to silk or black layer, a maturity date can be estimated. The Corn Growing Degree Calculator from the High Plains Regional Climate Center compiles current conditions into a 30-year historical perspective and offers trend projections through the end of the calendar year at the county level for 12 states in the Corn-Growing Area.

Table 1. Approximate Growing Degree Unit Requirements When Timely Planted to Reach Different Corn Growth Stages from Date of Planting (0 GDUs) for 2350 and 2700 GDU Corn Products.

Growth Stage (Leaf Collar Method)	Growing Degree Units	
	2350 GDU product[1]	2700 GDU product[2,3]
R1 (silking)	1250	1400
R5 (dent)	2130	2450
R6 (physiological maturity or black layer)	2350	2700

Sources: [6] Lauer, J. 1997. Healthy corn growth and development in Wisconsin. Agronomy Advice. University of Wisconsin. [7] Nafziger. E. 2009. Corn. Chapter 2. Illinois Agronomy Handbook. University of Illinois. [8] Hoeft, R.G., Nafziger, E.D., Johnson, R.R., and Aldrich, S.R. 2000. Modern Corn and Soybean Production.

Table 2. Average rate of grain moisture content loss in relation to growing degree unit (GDU) accumulation*

Mean Daily GDU Accumulation During Drydown	% Grain Moisture Content Loss per Day
12	0.5
17	0.6
22	0.75

*Three corn products planted from late April to early May, 1991-1994 in west central Indiana (Purdue University Agronomy Research Center).[5]

Sources:

[1] 2014. Corn development. Corn Agronomy. University of Wisconsin. www.corn.agronomy.wisc.edu/management/L011.aspx.

[2] Nielsen, B. 2001. Post-maturity grain drydown in the field. Agronomy Tips. Pest & Crop. No. 24. Purdue University. http://extension.entm.purdue.edu.

[3] Nielsen, R.L. 2013. Field drydown of mature corn grain. Corny News Network Articles. Purdue University. https://www.agry.purdue.edu/ext/corn/news/timeless/GrainDying.html.

[4] Nielsen, R.L. 2013. Grain fill stages in corn. Corny News Network Articles. Purdue University. https://www.agry.purdue.edu/ext/corn/news/timeless/GrainFill.html.

Web sources verified 8/30/2018.