



Agronomic Spotlight

Corn Maturity, Drydown, and GDU Accumulation 100-115 RM

- Corn kernels are around 30% moisture content when physiological maturity occurs.
- A cool growing season in combination with late planting can push harvest later into the fall.
- Cooler fall temperatures decrease the rate that the kernels lose moisture content.
- Delayed maturation can result in a less than desirable grain moisture content at harvest time.

Corn Maturity and Drydown

Corn kernels are around 30% moisture content when physiological maturity or black layer occurs (Figure 1). Several factors influence field drydown after maturity. Kernel moisture content decreases faster with warm, dry weather and may decrease slowly in a wet and cool environment. Fuller season corn products, that require more growing degree units (GDUs) to mature, will likely be slower drying as the fall progresses within an area. Crop maturity can be hastened by dry weather conditions, which usually results in a loss of potential yield because plant death occurs before the kernels gain their full weight and size.



Figure 1. Black layer at kernel tip.

Typical drying rates after black layer range from 0.4% to 0.8% kernel moisture content loss per day.¹ About 30 GDUs per point of moisture are required to dry corn from black layer to 25% moisture content.² Purdue University studies showed that a loss of 0.5% moisture content occurs when the mean accumulation of GDUs is 12 per day and 0.75% moisture content is lost when the mean accumulation of GDUs is 22 per day respectively (Table 1).

Corn products differ from one another in drydown rates. Plant characteristics that can influence drydown rate include:³

- **Number and Thickness of Husk Leaves.** Fewer husk leaves and thinner leaves can lead to faster moisture loss.
- **Husk Dieback.** Earlier dieback of husk leaves can lead to more rapid grain drying.
- **Ear Tip Exposure.** Exposed ear tips may provide for quicker grain moisture loss.
- **Husk Tightness.** Husks that are loose and open may help increase grain drying.
- **Ear Angle.** Drooping ears tend to lose moisture more quickly. Upright ears can capture moisture from rainfall.
- **Kernel Pericarp Properties.** Thinner pericarps (outer layer covering a corn kernel) have been associated with faster field drying rates.

Table 1. 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 in late April to early May, 1991-1994 in west central Indiana (Purdue University Agronomy Research Center). Source: Nielsen, B. 2001. Post-maturity grain drydown in the field. Agronomy Tips. Pest & Crop. Purdue University. <http://extension.entm.purdue.edu>.

Late Planting and Cool Weather Effects

Late-planted corn can result in taller plants, smaller diameter stalks, pollination when temperatures are hotter, and delayed maturation. Delayed maturation can result in a less than desirable grain moisture content well into the harvest season. Cooler fall temperatures decrease the rate that kernels lose moisture content. More importantly, an early frost can be a threat for late-planted corn or timely planted corn that experienced a cooler than expected growing season. A cool growing season in combination with late planting in some parts of the United States can push maturation into potential frost timeframes.

Frost Potential

The maturity of most corn products is based on the amount of GDUs required to reach black layer. Based on planting date, growing season temperatures, and the GDU maturity date for a product, an approximate calendar maturity date can be calculated for a corn product. This information can be used to help schedule harvesting, marketing of grain, and determining if extra fuel may be required for bin drying. The calendar date calculation can also be used to help determine if the product has an opportunity to mature before typical area frost dates.

Maturity Calculation

Some universities provide corn maturity calculators. By entering a location, planting date, and the GDUs to silk or black layer, a maturity date is then estimated. A variety of resources are available:

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The University of Wisconsin offers a calculator for your Android mobile device at the following site:

<http://ipcm.wisc.edu/blog/2013/08/new-android-app-crop-calculators-for-corn/>

The University of Vermont offers an Microsoft® Excel-based calculator:

<http://pss.uvm.edu/vtcrops/CompProg/GDDCalculator.xls>

South Dakota State University offers a web-based calculator:

<http://climate.sdstate.edu/awdn/archive/degreedays.asp>

Michigan State University offers weather-based pest, natural resource and production management tools online at:

<http://enviroweather.msu.edu>

A growing degree day calculator can also be found on The Weather Channel® website, weather.com for all locations. The accumulated growing degree days can be compared to the amount needed for the corn product planted.

<http://www.yourweekendview.com/outlook/agriculture/growing-degreedays/>

Table 2. Relationship between kernel growth stage and development (~100 day relative maturity corn product).

Growth Stage	Calendar Days to Maturity (average)	GDUs to Black Layer*	% of Maximum Yield	Approximate % Kernel Moisture
Silk (R1)	55-60	1100-1200	0	-
Blister (R2)	45-50	875-975	0-10	85-95
Late Milk-Dough (R4)	35-40	650-750	30-50	60-80
Early Dent (R5)	25-30	425-525	60-75	50-55
Fully Dented (5.5 to 5.75)	13-17	200-300	90-95	35-40
Physiological Maturity (R6)	0	0	100	25-35

*Black layer formation and/or milk disappearance from kernels under development. Premature frost or extended cold temperatures may cause black layer formation at earlier stages and wetter moistures. Source: Corn development. 2013. University of Wisconsin Department of Agronomy. <http://corn.agronomy.wisc.edu>

Table 3. Relationship between kernel growth stage and development (120 day relative maturity corn product).

Growth Stage	Approximate % Kernel Moisture	Days to Black Layer	% Total GDUs Accumulated	GDUs to Black Layer
Silk (R1)	-	57	54.5	1300
Blister (R2)	85	44	66	975
Milk (R3)	80	36	72.5	775
Late Milk - Dough (R4)	70	28	79.5	575
Early Dent (R5)	60	24	83	475
Fully Dented (5.5-5.75)	55	20	87	375
Physiological Maturity (R6)	30-35	0	100	0

Field drydown rate from 30 to 25% is 0.75% per day or to get below 25% is 0.25% per day. Sources: Hall, R.G. Corn growth stages with estimated calendar days and grow-degree units. South Dakota State University. Nielsen, R.L. 2008. Grain fill stages in corn. Corny News Network, Purdue University. Berglund, D.R. and Endres, G.J. 1999. Corn growth and management quick guide. North Dakota State University.

Sources

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- Geyer, A. and Thomison, P. 2006. Corn drydown. C.O.R.N. Newsletter 2006-28. The Ohio State University.
- Nielsen, R.L. 2011. Field drydown of mature corn grain. Corny News Network. Purdue University. <http://www.agry.purdue.edu/>
Web sources verified 8/1/2016. 130905070122

For additional agronomic information, please contact your local seed representative. Developed in partnership with Technology Development & Agronomy by Monsanto. Individual results may vary, and performance may vary from location to location and from year to year. This result may not be an indicator of results you may obtain as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible. ALWAYS READ AND FOLLOW PESTICIDE LABEL DIRECTIONS. All other trademarks are the property of their respective owners. ©2016 Monsanto Company. 130905070122 080116JMG