agKnowledge Spotlight
Shedding light on the concerns of your fields.

Frost and Corn Maturation

- Physiological maturity (black layer) for corn occurs when the kernel tip is sealed off from the flow of nutrients and water, and the plant has acquired the growing degree units (GDU) for its maturity.
- A late-planted corn product typically requires fewer GDU to reach maturity than if planted earlier.
- Depending on geography, black layer usually occurs about 55 to 65 days after silking.
- A cool growing season can delay black layer formation.

Physiological Maturity (Black Layer)

Physiological maturity (black layer) for corn occurs when the kernel becomes sealed off from the flow of nutrients and water, typically when the plant has acquired the number of growing degree units (GDU) for its maturity. The black layer is a film of black tissue that forms at the kernel tip where it attaches to the cob (Figure 1). The formation of the black layer stops potential gains in test weight and initiates the drying process of the kernel.

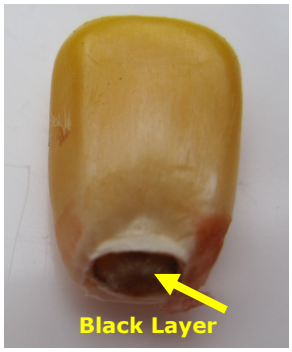

Figure 1. The black layer prevents the flow of nutrients and water from the cob and initiates kernel drydown.

Environmental conditions can cause premature or delayed formation of the black layer. Drought stressed plants can shut down too early for the product's maturity and force an early black layer. A cool growing season, which results in a slow accumulation of GDU, can delay development of the black layer.

Late Planting and Risk of a Killing Frost

Late-planted corn fields can become a risk of being damaged or killed by frost. Generally, the same corn product planted late requires fewer GDU to achieve black layer than an earlier planting. However, if temperatures are below normal during the growing season, GDU requirements for each stage of growth for the product may track closely with the normal GDU requirements for an earlier planting, increasing the chance of frost injury.

Timing of Physiological Maturation

Under normal Midwest planting dates and growing conditions, the calendar time from grain fill to physiological maturity is similar across a wide geographical area. Maturation for adapted corn products typically occurs about 65 days after silking in the central corn growing region and 55 to 60 days after silking in the northern corn growing region.[1] If silking does not occur until early August or later, black layer may not be achieved before the occurrence of a late September or early October killing frost, especially in the northern corn growing area.

Table 1. Potential Percent Loss of Grain Yield after Frost at Different Growth Stages[3]

Development Stage	Killing Frost	Light Frost (leaves dead, stalk alive)
R4 (Soft dough)	**55**	**35**
R5 (Dent)	**40**	**25**
R5.5 (50% milk)	**12**	**5**
R6 (Black layer)	**0**	**0**

Two ways to estimate the potential for a corn plant maturing before a killing frost are:

- Adding the 55 to 65 calendar days required for black layer development after pollination to the calendar date of pollination and checking historical information for the average first killing frost date for the area. This rule of thumb can be influenced by temperature during the grain fill period; warmer than normal temperatures can shorten the grain fill period and hasten maturity, while cooler than normal temperatures can lengthen grain fill and delay maturity.
- Estimating maturity date based on the anticipated GDU requirement from silking to black layer.

Frost and Yield Potential

A killing or light frost prior to black layer can affect yield potential and grain quality. The impact on corn yield depends on several factors including, the stage of corn development, the actual low temperature, and the duration of the low temperature. The closer the plant is to black layer, the less effect there is on grain yield (Table 1). Even if a frost kills most of the leaf tissue on the plant, the translocation of sugars from stalks to ears can still increase kernel dry weight unless the freeze is severe enough to kill the husks, stalks, and kernels.

Sources:
[1] Nielsen, R.L. 2011. Predicting corn grain maturity dates for delayed plantings. Corny News Network Articles, Purdue University. https://www.agry.purdue.edu/ext/corn/news/timeless/RStagePrediction.html.
[2] Hall, R.G. Corn growth stages with estimated calendar days and growing-degree units. South Dakota State University. https://www.sdstate.edu.
[3] Lauer, J. 1997. Killing frost in corn. Wisconsin Crop Manager. Corn Agronomy. University of Wisconsin. http://corn.agronomy.wisc.edu/WCM/W048.aspx.
Web sources verified 8/31/15.