Fall Frost and Corn Maturity

- Physiological maturity generally occurs when the plant has amassed its genetically “programmed” growing degree units (GDU) and a black layer has formed at the kernel tip.
- In general, a corn product that is planted late requires fewer GDU to reach maturity than if planted earlier.
- The black layer usually develops about 65 days after silking.
- Cool temperatures can increase the time needed to complete grain fill and delay black layer formation.

Physiological Maturity or Black Layer

Physiological maturity for corn occurs when the plant has obtained the number of growing degree units (GDU) for its maturity and the kernel becomes sealed off from the flow of nutrients and water. The sealing is a result of the formation of a black layer or a thin film of tissue on the tip of the kernel (Figure 1). After the black layer forms, the kernel begins its drying process.

Black layer formation can be influenced by environmental conditions. Drought can cause the black layer to form prematurely and cool conditions can delay its formation.

Late Planting and Risk of a Killing Frost

A late-planted corn crop could be at risk of being killed by frost. If crop maturation has been slowed by a cool growing season the chance for a killing frost can increase. Generally, the same corn product planted late requires fewer GDU to reach black layer than if it was planted earlier. 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 risk for frost damage.

Timing of Black Layer Development

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

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

- 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.

Yield potential and grain quality can be affected if a killing frost occurs before black layer. The impact on corn yield depends on the stage of corn development, the low temperature reached, the duration of the low temperature, and other factors. 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.

Table 1. Potential % Loss of Grain Yield after Frost at Different Growth Stages

<table>
<thead>
<tr>
<th>Development Stage</th>
<th>Killing Frost</th>
<th>Light Frost (leaves dead, stalk alive)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R4 (Soft dough)</td>
<td>55</td>
<td>35</td>
</tr>
<tr>
<td>R5 (Dent)</td>
<td>40</td>
<td>25</td>
</tr>
<tr>
<td>R5.5 (50% milk)</td>
<td>12</td>
<td>5</td>
</tr>
<tr>
<td>R6 (Black layer)</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Sources:
Web sources verified 8/31/15.