AGRONOMIC Spotlight

Technology Development by MONSANTO SM

# High Night-Time Temperatures and Stalk Cannibalization in Corn

**Grain fill is a time of high physiological demand for the corn plant of which the developing ear becomes a very strong sink. If a stress such as high night-time temperatures occurs during grain fill, the plant may compensate through early maturation or stalk cannibalization resulting in potential yield loss.**

## Plant Biology

A review of two biological processes will help explain what happens in the plant when high night-time temperatures occur. Photosynthesis is the process plants use by combining sunlight, water, and carbon dioxide to produce energy for the plant (sugars) and the byproduct, oxygen. Dark respiration is a two part process in which the plant uses the sugars produced in photosynthesis for growth and maintenance. Unlike photosynthesis, respiration is a continuous process because it does not require light.

## High Night-Time Temperatures

When night-time temperatures above 70° to 80° F, respiration rates are higher and dry matter accumulation is lower. The exact temperature that may cause stress depends on what other environmental conditions are present. Dr. Peter Thomison, Ohio State University, reports that for each 13° F increase in temperature, respiration rates may double. During this time the plant uses more of the sugars produced during photosynthesis for maintenance instead of growth. Simply stated, the plant is working to stay alive resulting in less energy available for the developing kernels.

## Stalk Cannibalization

In an effort to fill the ear, corn plants may respond to stress by remobilizing, or moving, stored sugars from the stalk and leaf tissue to developing ears. This process, also known as stalk cannibalization, weakens the stalk and makes it more susceptible to diseases. Dr. Nielsen, Purdue University, indicates even if stalk rot does not develop, loss of the stalk integrity and structure from remobilization can increase the risk of stalk breakage.

It is important to note that ratings for stalk strength and lodging vary by hybrid which can be influenced by genetic background, fertility levels and management practices. In addition, company ratings for stalk strength may vary in their definitions. Some may be based on literal stalk strength as determined by stalk diameter, and stalk rind thickness, while others are an integrated rating based on stalk strength components and disease resistance.

Weak stalks are more susceptible to stalk rots which, depending on the season, can lead to a 5% to 20% loss of yield potential. In addition to ears drawing energy from the stalks, stalk weaknesses can also be attributed to:

- A reduction in photosynthesis due to foliar diseases.
- Damage to plant structure from hail or insect and nematode feeding.
- A tough growing environment from nutrient deficiency or imbalance, compaction, excessive plant population, or moisture extremes.

## Scouting

Experts agree that scouting to assess stalk health is the best way to avoid severe stalk lodging and yield losses. Gibberella, Fusarium, Anthracnose, and Diplodia are possible diseases to watch for in stalks. Typical symptoms of infected stalks may include lower internodes that have turned tan to dark brown in color and can be easily crushed. In addition, the interior of these stalks will display disintegrated pith tissue (Figure 1).

Stalk rot can be detected by either pinching the stalk for firmness between the two lower nodes or splitting stalks. Pinching the stalks may be best because it is less destructive and less time consuming. Plus, it predicts lodging potential. Dr. Munkvold, Iowa State University, recommends scouting before black layer which is approximately 40 to 50 days after pollination. When corn kernels have reached 30% to 40% moisture content, scout fields weekly by walking in a zig-zag pattern through the field and pinching at least 100 random plants. If more than 10% to 15% of the stalks fail the pinch

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test, the field should be harvested as soon as possible. Visual signs may also be evident. Aside from broken or lodged stalks, symptoms common to all stalk rot diseases follow:

- Early symptoms usually start with premature dying of bottom leaves a few weeks after pollination.
- Stalks usually begin losing firmness around August.
- Eventually, the entire plant may die and appear light green to gray.

## Management

Stalk rot may be prevented by following these management techniques:

A. Select hybrids with good stalk and lodging ratings and also resistance to foliar diseases

B. Plant appropriate plant populations for each hybrid.

C. Keeping fertility levels balanced, especially with respect to potassium and nitrogen

D. Help to avoid or minimize stress to corn, especially during pollination and grain fill:
   i. Control insects to help avoid root and stalk injury by planting one of the Genuity® family of traits.
   ii. Manage weeds with multiple modes of action, including adding other herbicides to glyphosate for tough weeds.
   iii. Rotate crops to cut down on pathogen survival
   iv. Provide good drainage to help avoid conditions conducive to rot and other diseases
   v. Provide proper irrigation (where applicable) to help avoid moisture stress

E. Harvest in a timely manner to help minimize the risk of significant mechanical harvest losses

Figure 1. Stalk with fungal rot (left) and a healthy stalk (right). Picture courtesy of Dr. Peter Thomison, Ohio State University.

*Sources: D. Malvick and D. Nicolai. 2005. Corn Stalk Rots in Minnesota This Year. University of Minnesota. Extension Service. Minnesota Crop eNews; G. Munkfoldt. 2002. Time to start scouting for corn stalk rot. Iowa State University. Integrated Pest Management. ICM > 2002 > IC-488(20) -- August 19, 2002; R.L. Nielsen. 2008. Stress During Grain Fill: A Harbinger of Stalk Health Problems. Purdue University. Department of Agronomy. Corny News Network Articles. September 1,2008; R.L. Nielsen. 2009. Field drydown of mature corn grain. Purdue University. Corny News Network.September 2009; R.L. Nielsen. 2009. Effects of Stress During Grain Filling in Corn. Purdue University. Corny News Network August 2009; L. Sweets. 2008. Corn Stalk Rots. University of Missouri.September 29, 2008 100 Volume 18, Number 15; P.Thomison,et al. 2008. Dry Weather May Lead to Stalk Lodging Problems in Corn. Ohio State University. C.O.R.N. Newsletter 2008-28. August 25, 2008 - September 2, 2008; Thomison, P. 2010. Can warm nights reduce grain yield in corn? Ohio State University. C.O.R.N. Newsletter 2010-22; P. Vincelli and D.E. Hershma. 2009. Corn Stalk Rots. University of Kentucky. College of Agriculture Extension Publications.Publication PPA 26; Thomison, P. 2010. Can warm nights reduce grain yield in corn? The Ohio State University. C.O.R.N. Newsletter.*