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Corn growth and yield formation in light of fungicide applications at tasseling

Roger W. Elmore
Iowa State University, relmore@iastate.edu

Lori Abendroth
Iowa State University, labend@iastate.edu

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Abstract
Tassels top many of our corn fields with more to appear every day. The critical corn pollination time is near indeed. Soon the roar of spray planes will add a sense of urgency as will high-clearance sprayers gliding over an ocean of tall corn. Fungicide applications made to attain improved "plant health" while controlling limited disease pressure are prime topics in extension offices, coffee shops, elevators, and pickup trucks around the Corn Belt.

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Corn growth and yield formation in light of fungicide applications at tasseling

by Roger Elmore and Lori Abendroth, Department of Agronomy

Tassels top many of our corn fields with more to appear every day. The critical corn pollination time is near indeed. Soon the roar of spray planes will add a sense of urgency as will high-clearance sprayers gliding over an ocean of tall corn. Fungicide applications made to attain improved "plant health" while controlling limited disease pressure are prime topics in extension offices, coffee shops, elevators, and pickup trucks around the Corn Belt.

Tasseling has begun around Iowa.

Through what mechanisms would fungicide application improve yields when applied at tasseling (VT)? In order to know this, first understanding how yield accumulates in corn is crucial in determining why stress at different times in a plant's growth is especially negative. Yield is the accumulation of five key elements expressed as:

A X B X C X D X E = YIELD

Plants per acre X Ears per plant X Rows per ear X Kernels per row X Weight per kernel = Yield per acre

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In an ideal environment with no stress agents, the order in the equation is the sequence in which the various elements are determined. Several forces can alter the progression of this. For example, plant removal at various times due to crusting, cultivator damage, insect feeding, hail, greensnap, stalk lodging, etc. will affect the entire process.

To understand how fungicide protection at tasseling and shortly thereafter might affect final yield, it is necessary to see which of the yield components will be impacted:

(A) Plants per acre are normally determined by a combination of seed germination (seed quality) and soil environment at planting and germination, although other factors can alter this as noted above.

(B) Ears per plant as well as tassel size are both determined by the 5th or 6th leaf stage (V5 to V6). All leaves and ear shoots are visible with dissection by V10. Primary ears will form at the 12th to 14th leaf node depending on hybrid. Ear shoots are formed on all aboveground nodes except the upper six to eight nodes. Usually only one ear develops kernels.

(C) Rows per ear are determined by V6. Hybrid genetics is instrumental in determining the potential number of rows per ear, yet environmental factors have an influence, especially if severe.

(D) Kernels per row are determined between V12 and tasseling (VT). The maximum number of ovules (potential kernels) per row is set a week or so before silks emerge. Stress during this time will reduce kernel numbers per row. Some researchers estimate there are up to 1,000 potential ovules per ear (that could develop into kernels), yet only 400 to 600 will develop into harvestable kernels. An ovule develops into a kernel when its silk receives pollen, is fertilized, and then develops without aborting. Potential kernels per row are highly dependent on growing conditions prior to silking while actual kernels per ear are determined by conditions during and after silking.

At tasseling, VT, all the plants' stover (leaves, stalks, husks, cobs) are in place and are at or near final weight. The amount of pollen produced within hybrid fields is typically sufficient for pollination as 2,000 to 5,000 pollen grains are produced for every one silk. One grain of pollen pollinates one silk. Pollen usually sheds slightly before silking. Silks are receptive for approximately 10 days. If stress occurs during this time, the synchronization between pollen shed and silk receptivity may not line up, resulting in reduced pollination and fertilization. At silking, R1, corn plants require up to 0.35 inches of water per day. This is the greatest per day usage of any time in the growing season; therefore, moisture stress at the R1 stage reduces kernel numbers. Moisture stress causes silk emergence to slow while pollen shed accelerates. Some kernels will simply not develop due to a failure in pollination or fertilization. Kernels can be aborted in response to stress from R1 through the milk stage (R3). Abortion typically starts at the tip of the ear; hence, it is referred to as tipping back.

(E) Kernel weights are determined until black layer (physiological maturity, R6). Stress that occurs before R6 reduces starch accumulation in the kernel, resulting in lighter seed (lower kernel weight). The converse is true as well: anything that reduces stress between R1 and R6 may increase kernel weights.

Summary

Although stress inherently reduces yield, the plant has great capabilities for responding to

adverse growing conditions. This is obvious with the multiple factors used in the yield equation. Yield is not a result of one or two factors but instead a combination of several criteria over the entire length of the growing season. Applying a fungicide that has a 2- to 3-week window of viability is simply protecting the plant for a small window of time. If conditions exist during that time that significantly reduce yield, then the producer may see a yield response to a fungicide application. Maximum yield potential is determined by VT. After this, the focus is completely on preserving that yield potential. Late-season stress will reduce that yield potential, but nothing can increase the maximum level of what is possible.

Before applying fungicides to corn: Stop! Look! Consider!" notes things to consider when deciding whether to apply a fungicide. An article in *The Bulletin* (Issue 14, Article 10, 29 June 2007) by Emerson Nafziger, University of Illinois, provides third-party yield data on fungicide performance.

By controlling diseases for two to three weeks after tasseling and/or affecting the plants' physiology (by improving "plant health"), fungicides could potentially aid in kernel retention and increase kernel weights. Therefore, by reducing stress at or after VT, yield could be increased through more kernels per row and greater kernel weights.

Roger Elmore is a professor of agronomy with research and extension responsibilities in corn production. Lori Abendroth is an agronomy specialist with research and extension responsibilities in corn production.

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