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DISEASES OF CORN

Arrested Ear Development in Hybrid Corn

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Photos by Nathan Stetzel except where noted

Arrested ear development is a physiological disorder that can significantly reduce corn yields. It is not a disease, but refers to the abnormal corn ear development caused by a number of stress factors, including the application of nonionic surfactant adjuvants.

Figure 1. Typical symptoms of arrested ear development at maturity. Photo by Bob Nielsen.

At maturity, arrested ears have shorter cobs, fewer kernels per ear, and a stunted cob tip (Figure 1). Arrested ear development symptoms are distinctly different from other ear abnormalities, so it is important to correctly identify arrested ear development symptoms and to understand its cause.

This publication describes the cause and symptoms of arrested ear development, and provides recommendations on how to avoid it.

Cause and Symptoms

Reports of arrested ear development were particularly numerous in the Midwest during the 2007 growing season. These symptoms resulted in significant yield loss and coincided with an increase in foliar fungicide applications applied late during the vegetative period (approximately one week prior to pollination) that same year.

Subsequent Purdue research has indicated that applying a nonionic surfactant (NIS) prior to tasseling (VT growth stage), with or without foliar fungicides can cause arrested ear development. The risk appears to be highest from growth stages V12 to V14 (12 to 14 exposed leaf collars), or about one to two weeks prior to pollination. The research shows that fungicide applications alone do not cause arrested ear development.

Symptoms can be observed primarily on four parts of the corn plant: ears, husks, silks, and leaves.

Ears

Ear symptoms can be seen as early as seven days after foliar applications, but are more obvious after 21 days. Some portion of the cob development, along with ovule development at the tip end of the ear, appears to prematurely cease shortly after a foliar application (Figure 2). At maturity, arrested ears are shorter, have significantly fewer kernels, and have dried and stunted tips (Figure 3).

Figure 2. The bottom ear shows symptoms of arrested ear development seven to ten days after foliar spray application. The top two ears show normal development.

Figure 3. An arrested ear at physiological maturity (bottom) and a normal ear at maturity.

In a moderately arrested ear, the base may appear normal, but have abnormal development between the base and tip of the ear (Figure 4). In severely arrested ears, cob and ovule development cease completely at an early stage of development (Figure 5).

Husks

Husk symptoms become increasingly visible during the grain fill period following pollination. An arrested ear has more slender husk appearance that is pointed at the tip due to the smaller and under-developed ear shoot (Figure 6). The number and length of the outer husk leaves remain relatively normal.

The husks will feel hollow when squeezed, leading to an alternative term for arrested ear development: hollow husk (Below et al., 2009). On severely arrested ears,

Figure 4. Both of these ears show moderately arrested ear development. Pollination and kernel development still occurred, but at a significantly reduced amount.

Figure 5. Symptoms of a severely arrested ear at physiological maturity.

Figure 6. The ear on the left shows husk and silk symptoms of arrested ear development. Symptoms appeared 28 days after a spray application at V14 (14-leaf collars visible).

inner husk leaves (immediately adjacent to the ear) often appear crinkled and are shorter than normal.

Silks

Silk emergence in arrested ears is greatly reduced and may be nonexistent in the case of severely arrested ears (Figure 6). This is mainly due to the cob and ovules being undeveloped, and partially due to the tightness and shape of the husk leaves, which impede silk emergence. In moderately arrested ears, silk emergence and kernel pollination can occur, but are significantly reduced.

Leaves

Plants with arrested ears do not show leaf symptoms until the grain fill period. In a severely affected plant, the leaf mid-ribs, blades, and sheaths may turn purplish red. Eventually, the stalks may exhibit this color as well.

Figure 7. A corn plant affected by severe arrested ear development exhibiting purplish red leaves.

This discoloration is caused by an accumulation of anthocyanin pigments in response to high concentrations of plant sugars in the leaves (Figure 7; Nielsen, 2007). These high sugar concentrations occur in the leaves because affected plants have fewer developing kernels to accept the sugars produced by photosynthesis. Purplish red leaves are a general symptom of poor kernel set, not just arrested ear development.

How to Avoid Arrested Ear Development

Purdue research suggests that the risk of arrested ear development can be reduced by simply avoiding the use of NIS spray additives with foliar pesticide applications during growth stages V10 to VT.

Specimen labels and some supplemental fungicide labels state that NIS products are prohibited from growth stages V8 to VT (BASF 2009a, b, c).

Preliminary trials at Purdue suggest that using NIS spray adjuvants in foliar fungicide applications at VT may be safe relative to kernel development. Current research is focused on determining which class or chemistry of NIS spray adjuvant has the highest risk for arrested ear development.

Arrested ear development can significantly reduce grain yield in hybrid corn. The magnitude of the yield reduction depends both on the severity of the arrested development and the percentage of plants affected in a field. Because these two factors can vary throughout an affected field, it is difficult to predict the exact yield loss prior to harvest.

References

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Find Out More

More information about arrested ear development is available from the Corny News Network at Purdue:
www.agry.purdue.edu/ext/corn/news/articles.08/ArrestedEars-1209.html

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