

## Early Season Fungicide Applications to Corn

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### Summary

- Foliar fungicide applications can be an important component of an effective corn disease management strategy.
- The economic value of a fungicide treatment varies depending on disease pressure, hybrid susceptibility, production practices, weather conditions and corn prices.
- Research has shown that the optimum timing for a foliar fungicide application in corn is between tasseling (VT) and brown silk (R2).
- Tank-mixing with a post-emergence herbicide application applied at V5 to V6 is a convenient, low-cost way to apply a fungicide; however, most fungal diseases are not present until later in the growing season.
- Research thus far has generally not shown a cost-effective yield benefit to early fungicide applications, either alone or in conjunction with a post-tasseling application.
- Fungicide resistance prevention should also be considered in treatment decisions. The strobilurin class of fungicides is considered high risk for resistance development in fungal species.

### Introduction

Foliar fungicides have proven to be an effective way to help protect corn yield by managing foliar diseases. Many research studies have shown significant yield increases when fungicides are applied between tasseling (VT) and brown silk (R2) (Jeschke, 2008). The VT to R2 period is just prior to the time of development of many major foliar diseases.

Recently, fungicide manufacturers have been promoting early season fungicide applications, around V5 to V7, as a way to provide additional yield protection. This early season treatment has generally been promoted as a supplement to a VT application rather than a replacement for it. Because this would incur additional costs, growers have questioned whether the application can produce a profitable return by controlling diseases early and increasing yield.

In considering the potential value of an early season fungicide application, it is worth reviewing what is already known about VT fungicide applications. In 442 Pioneer



on-farm comparisons conducted between 2007 and 2010, a positive yield response to fungicides applied following tasseling was observed 79% of the time (Jeschke 2010). The average yield response was 7.0 bu/acre, which clearly provides an economic benefit when corn prices are very high. However, even 7.0 bu/acre may be insufficient to cover the cost of product and application when corn prices are lower, and this average response will not be realized by all growers.

Early season fungicide treatments can be applied at lower cost, and thus require less yield response to be profitable. Tank mixing with a post-emergence herbicide allows a fungicide to be sprayed without any additional application cost\*. Lower use rates with early season applications can reduce the break-even point even further. However, even with the lower economic threshold, an early application still needs to provide enough additional yield to justify the expense.

### Potential Value of Early Fungicide Application

The V5 to V6 growth period is a critical phase in corn development. The number of kernel rows per ear is set at this time and can be reduced by plant stress, impacting yield. Foliar diseases are one such stress capable of reducing yield in corn; however the only economically important foliar diseases generally present during the early vegetative growth stages are anthracnose leaf blight and eyespot. Holcus spot can also appear early in the season, but it is a bacterial disease not controlled by fungicides.

\*Always read and follow label directions

**Anthracnose leaf blight** is usually the first foliar disease to appear during the growing season. The pathogen overwinters in corn residue, so infection is most common in corn-following-corn. Anthracnose leaf blight can be very damaging to corn seedlings, potentially resulting in stand loss in severe cases. However, once a corn plant reaches the V6 stage, the disease generally does not continue to spread to new leaves. A fungicide applied during the V5 to V7 stages would be too late to completely control the disease, and would likely not provide much additional protection beyond that period. The leaf blight phase of anthracnose is not necessarily a precursor to stalk rot, as anthracnose stalk rot is generally caused by fungal infection through the roots.



*Anthracnose leaf blight*

**Eyespot** is most common in the northern Corn Belt and overwinters in corn residue. Eyespot is favored by cool and wet conditions and is typically most prevalent late in the growing season. Under favorable conditions however, symptoms can appear much earlier, beginning at around V6. Early-season infections generally do not affect yield except in very severe cases. Fungicides are rarely needed to control this disease, and typically should only be considered in corn following corn with reduced or no tillage.



*Eyespot leaf disease*

Fungicides applied at the V5 to V7 stages would not be expected to provide much protection against foliar diseases that occur later in the season such as gray leaf spot and northern leaf blight. Fungicides commonly used in corn are generally locally or xylem mobile within the plant, which allows the fungicide to move within a treated leaf, but not to other plant parts or to newly emerging leaves. The residual period of fungicides is usually about 14 days in the case of triazoles and 7 to 21 days for strobilurins, so a treatment at V5 to V7 would have little if any remaining activity later in the season when foliar diseases are most active.



*Gray leaf spot*



*Corn field at the V6 to V7 growth stage*

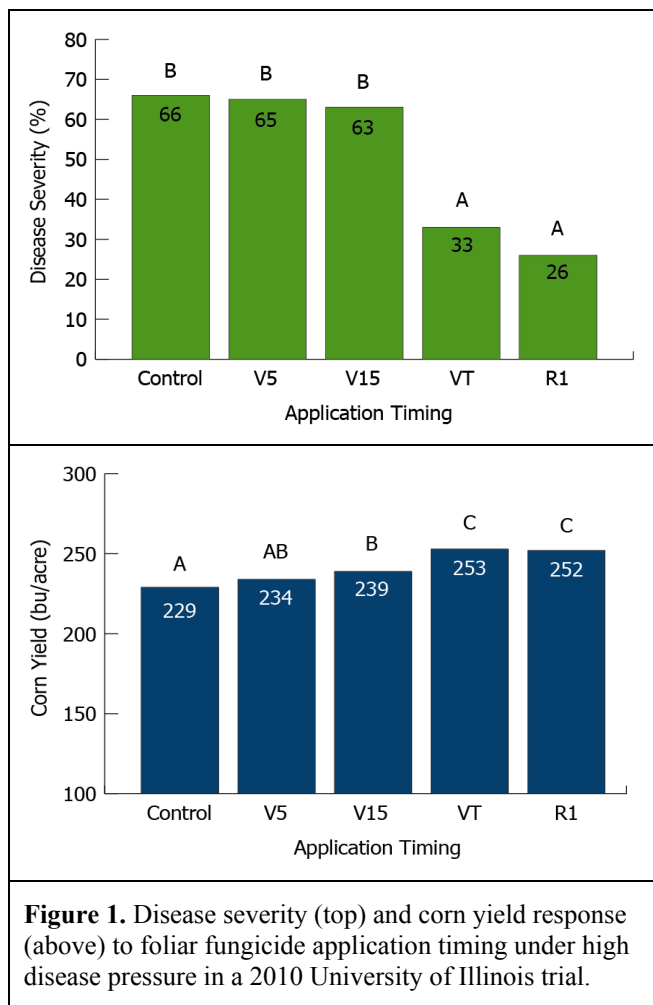
## Early Season Fungicide Research

Research data on the yield response of corn to early season fungicide applications are limited, but so far have not been highly positive. A survey of university trials conducted through 2009 compiled by Dr. Carl Bradley at the University of Illinois showed an average yield response of 8.0 bu/acre for VT to R1 applications, compared to 1.5 bu/acre for V6 applications (Bradley 2010). This included eight studies conducted by university scientists in Illinois, Iowa, Nebraska, and Wisconsin. Five additional on-farm trials conducted in 2010 showed similar results (Table 1). These data indicate that the yield benefits of an early season fungicide application are not sufficient to consider using it to replace a post-tasseling application.

**Table 1.** Corn grain yield responses to fungicide applications at early and traditional plant growth stages.

Source	Location	V6	VT-R1
		---- bu/acre ----	
U. of IL Summary	WI	7.8	-14.1
U. of IL Summary	IL	4.3	4.3
U. of IL Summary	IN	-10.5	-9.5
U. of IL Summary	IA	-2.0	26.0
U. of IL Summary	IA	-9.3	4.2
U. of IL Summary	NE	1.5	24.1
U. of IL Summary	NE	19.3	21.9
U. of IL Summary	NE	1.1	8.0
2010 On-Farm Trial	IN	-0.2	6.4
2010 On-Farm Trial	IA	3.9	
2010 On-Farm Trial	IL	1.4	
2010 On-Farm Trial	IL	-1.2	
2010 On-Farm Trial	IL	0.3	
<b>Average</b>		<b>1.3</b>	<b>7.9</b>

A University of Illinois research trial conducted in 2010 provided further evidence that an early season fungicide application is not an effective replacement for a post-tasseling application. In this trial, applications at VT or R1 provided optimal disease control and yield protection under high disease pressure, whereas a single application at V5 provided no significant benefits relative to the non-treated control (Adee and Johnson 2010, Figure 1).

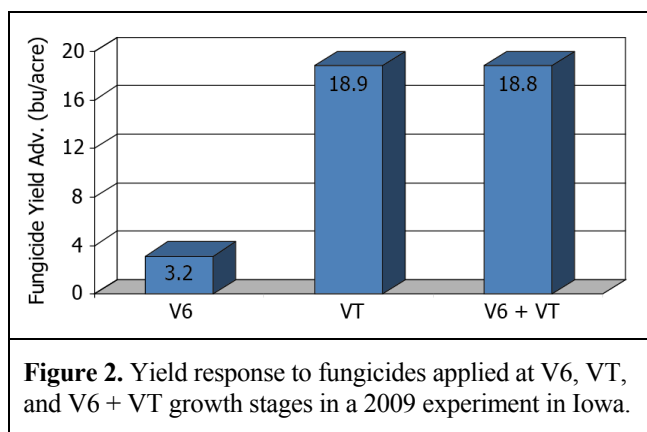


**Figure 1.** Disease severity (top) and corn yield response (above) to foliar fungicide application timing under high disease pressure in a 2010 University of Illinois trial.

Research thus far has also not indicated that a V6 application plus a VT application would generally provide any greater yield benefit than a VT treatment alone. For example, an experiment conducted in Iowa in 2009 found similar yield responses between sequential V6 and VT applications and a VT-only application (Robertson 2010, Figure 2).

## Conclusions

Information on the value of early season fungicide applications in corn is still somewhat limited; however, research to date indicates it is unlikely this practice will offer a



**Figure 2.** Yield response to fungicides applied at V6, VT, and V6 + VT growth stages in a 2009 experiment in Iowa.

consistent economic benefit. Symptoms of most important foliar diseases do not begin to develop until well after the V5 to V7 growth stages. For this reason, the addition of an early season application prior to a VT application would not be expected to provide much additional disease protection in most cases. Pioneer Hi-Bred is conducting studies in 2011 to further investigate the effects of early season fungicide treatments on corn yield.

Fungicide resistance prevention should also be considered in treatment decisions. The strobilurin class of fungicides, although very effective at controlling many corn diseases, is considered high risk for resistance development in fungal species. Strobilurin resistance has already been documented in disease species in other crops, most recently frogeye leaf spot in soybean. It is likely only a matter of time before resistance occurs in a corn pathogen. Widespread indiscriminant use of fungicides increases the selection pressure on fungal pathogens, which can accelerate resistance development.

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