

FOLIAR FUNGICIDE DECISIONS FOR LATE-PLANTED CROPS

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A record number of corn and soybean acres were planted late in 2019, and have reduced yield potential. Weather conditions have also been favorable for foliar disease development. In a typical year, weather and disease risk factors would be enough to determine if a fungicide is necessary; however, the lower yield potential in late planted crops across much of the U.S. and southern Ontario has complicated this decision making process. Many farmers are now asking if fungicide application(s) will provide an adequate return on investment.

The answer to this question will be crop, region, state and field specific. However, there are guidelines that can aid in determining if a fungicide application will be a sound investment in 2019.

How much yield is there to protect?

Knowing plant populations in a given field is critical for estimating how much yield a fungicide can protect. Figure 1 illustrates the yield potential of corn based on planting date, and plant populations per acre for Iowa. As an example, the chart shows the substantial drop-off in yield potential from planting in mid-May to early June, even with high planting populations.

Soybean yield potential is less affected by planting date because soybeans are photoperiod sensitive, meaning that even if planting occurred across several days or weeks, the plant adapts based on daylength. It is still possible to achieve 90 percent of full yield potential if soybeans were planted by June 1. However, planting past June 15 limits yield potential to approximately 80 percent (Figure 2). Iowa State University Extension has developed a [Soybean Planting Decision Tool](#) that evaluates planting dates and yield potential for Iowa, Missouri and Minnesota.

Table 1. Relative yield potential of corn by planting date and population. Note: Values based on preliminary Iowa research and modeling; 100% yield potential is estimated to occur with 35,000 plant population and early planting. Data courtesy Corn and Soybean Field Guide, IPM 0001, Iowa State University Extension and Outreach.

Population Plants/Acre	Planting Date				
	April 20-May 5	May 5- May 15	May 15- May 25	May 25- June 5	June 5- June 15
	Percent Maximum Yield				
45,000	97	93	85	68	52
40,000	99	95	86	69	53
35,000	100	96	87	70	54
30,000	99	95	86	69	53
25,000	95	91	83	67	51
20,000	89	85	77	63	48
15,000	81	78	71	57	44
10,000	71	68	62	50	38

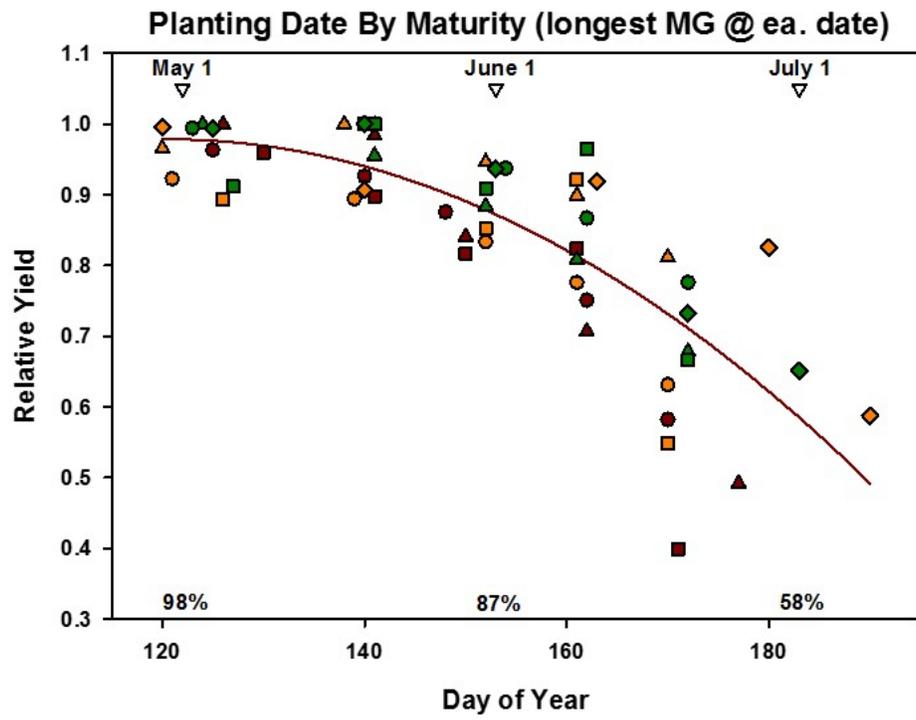


Figure 2. Yield potential (relative yield) based on planting date from May 1st (120) to July 1 by maturity group (MG) at various locations in WI. Courtesy Shawn Conley, University of Wisconsin-Madison.

Will disease be severe enough to warrant a fungicide application?

To determine if diseases will be present and/or severe, we need to understand the disease triangle. This concept is the foundation for understanding how plant diseases develop and how to manage them. In order for a plant disease to occur, a pathogen capable of infecting a given host must be present, a susceptible host plant, and favorable weather conditions must occur at the same time. If any one of these three components are missing (or we implement a management strategy that removes or reduces one or more components) then a plant disease will not occur, or occur at such low levels that yield is not affected. A graphic to help illustrate this can be found [here](#). For example, if you planted a corn hybrid or soybean variety that is resistant to foliar diseases like [gray leaf spot](#) in corn, or [frogeye leaf spot](#) in soybean, it is less likely that you will see an economic benefit from a fungicide application. Also, if weather conditions change as the crop develops and become less favorable for disease development, disease progress may slow, reducing the need for a fungicide application.

What growth stage is the crop when disease is first observed?

Disease development prior to grain fill will have a greater impact on yield reduction than when disease develops later in the cropping season. In a typical year, crops are usually at a more mature stage of development when diseases become prevalent, and thus there is less impact on yield. This year however, with delayed planting conditions and reduced growing degree day accumulation, corn and soybean development in many areas is two to four weeks behind normal. Disease development prior to or during early grain fill could significantly affect yield, thus scouting fields for yield limiting diseases prior to reproductive stages will be crucial in determining whether or not to apply a fungicide.

Corn

Diseases like [gray leaf spot](#) and [northern corn leaf blight](#) (NCLB) have already been confirmed on corn prior to tassel in some areas. Gray leaf spot is favored by warm temperatures, high humidity, and heavy dews. NCLB is favored by cool temperatures and wet leaves. Both of these diseases typically start in the lower canopy, and if favorable conditions continue, they can quickly spread to the upper canopy and be very damaging. Similarly, the development of tar spot before R2-R3 may cause considerable damage and yield loss. University research indicates that fungicide applications occurring at tasseling/silking (VT-R1) are most effective at minimizing the impact of gray leaf spot and NCLB and protecting yield in susceptible hybrids. Southern rust could also be problematic in late-planted corn in 2019. This disease moves northward each year and may impact yields in late-planted corn. Fungicide applications prior to milk stage (R3) may be needed to limit yield impact in certain cases.

Soybean

[Frogeye leaf spot](#) and [Septoria brown spot](#) are two foliar diseases that are prevalent in wet and humid weather. Septoria brown spot generally is not an economic threat to soybean, but may cause yield reductions if infection reaches the upper canopy. It is important to begin scouting soybean fields for frogeye leaf spot and Septoria brown spot around beginning flower (R1) to help make a foliar fungicide decision. Generally, fungicide applications for management of frogeye leaf spot on susceptible varieties are made at beginning pod (R3). It is not likely that foliar fungicide applications to soybean prior to reproductive stages will be economical. If using foliar fungicides to manage these diseases, use products that contain multiple fungicide classes, as resistance to strobilurin (quinone outside inhibitor) fungicides has been observed in multiple states by both the frogeye leaf spot and the Septoria brown spot fungi.

In the northern soybean-production regions (I- 80 and north) [white mold](#) (*Sclerotinia stem rot*) may be of concern. All stages of soybean are susceptible to infection by the white mold fungus, but most infection occurs through open flowers during periods of cool and wet weather. If we continue in a cool, wet weather pattern this year, late-planted soybeans will flower further into the growing season due to less accumulated growth days. Plants will be more susceptible to infection for a longer period of time when the weather is very conducive to disease.

What is the frost risk for late-planted crops?

One last point to consider is the likelihood for late-season frost to impact yield in 2019. Late planted crops may not have completed grain fill or mature fully, thus would be at risk for yield loss due to frost. If corn has not achieved enough growth degree units before frost, this greatly decreases quality of grain.

The dense soybean canopy reduces frost damage by holding heat, unlike open (less developed) canopies. Late planting can reduce canopy coverage. In addition, late planted soybeans may mature slower, thus be more susceptible to frost damage. Yield can be greatly reduced if frost occurs before soybeans are in the R8 stage. [The University of Minnesota published a study evaluating frost impacts on soybean and yield results.](#)

So do I apply a fungicide, or not?

Application of a fungicide is most effective on hybrids/varieties that are rated susceptible or moderately susceptible to

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ce. So, when evaluating whether or not to apply a fungicide, first check hybrid/variety susceptibility ratings to foliar diseases. With this information in mind, scout fields for disease, ideally before plants enter reproductive growth stages, and determine the incidence and severity of disease. After scouting, evaluate how

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$$\text{Yield protected (bu/A)} = \text{application cost (\$/A)} / \text{crop price (\$/bu)}$$

If the rate of return is positive after this calculation, keep in mind the potential yield lost in response to a late season frost, then compare the costs. After all of these calculations, you should have a good idea at the rate of return, should

you apply a foliar fungicide. The Crop Protection Network, a multi-state and international collaboration of university/provincial extension specialists and public/ private professionals that provides unbiased, research-based information to farmers and agricultural personnel.

Specific economic data is available for fungicide applications in late-planted Midwest soybean production systems in **The resource** [Be this publication](#) [Soybean guide](#) and the authors assume no liability for practices published here or in this year's **Data**

from this University of Wisconsin-Madison study shows that the application of foliar fungicides to late-planted (May 21-June 10) minimal-till soybean was positively correlated with a 4.2 bu/A increase in parts of Iowa, Illinois, and

Wisconsin. In this area, the average yield was 52.8 bu/ac, and fields with foliar fungicide yielded 55 bu/ac. At a grain price of \$8/bu, the break-even price for foliar fungicide and its application is \$33.60/ac. These data suggest that fungicide application costs below \$33 are likely to improve profits on a per-acre basis in this specific area.

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Active disease monitoring is occurring across the United States and Ontario. These reports are found in weekly newsletters, maps ([//corn.ipmPIPE.org/](http://corn.ipmPIPE.org/); and [//soybean.ipmPIPE.org/](http://soybean.ipmPIPE.org/)), and Extension crop management websites. Contact your local extension personnel or submit samples to your state diagnostic laboratory if you have questions.

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