Q. When and how did tar spot get to the United States?
A. One theory is that wind-blown spores from a tropical storm in 2015 were deposited in northern Illinois and northern Indiana. That year, tar spot, including the fish-eye symptoms, was found in several counties in northern Illinois.

Q. Where can it be found?
A. Currently, tar spot has been confirmed across a widespread area of eastern Iowa, central and northern Illinois, southern Wisconsin, northern Indiana, southern Michigan and northwest Ohio. The earliest reported and most heavily infected areas in 2018 have been in northern Illinois and southern Wisconsin, though the disease did appear to reach significant levels by harvest in Michigan and eastern Iowa.

Q. What conditions favor tar spot development?
A. Based on research from Mexico, P. maydis prefers cooler temperatures (specifically in the 50-70 degree range). Additional research is needed regarding the conditions favorable for disease development in the U.S. Extended leaf wetness, high humidity and frequent rainfall can help initiate and promote disease development.

Several areas with fields experiencing severe tar spot symptoms saw high amounts of rainfall in June, whereas rainfall in July and August varied among these areas. One might speculate that extended hours of leaf wetness and high humidity following June rains may have contributed to epidemic levels of tar spot in these areas, although that is not known at this time. We continue to review internal data, weather patterns and work with university researchers to understand how and why tar spot became a widespread issue in 2018.

// WHAT IS TAR SPOT?
Tar Spot is a fungal disease caused by Phyllachora maydis. It originates from areas of Mexico and Central and South America.
In native regions, it is referred to as the Tar Spot Complex, because of the involvement of an additional pathogen that causes the disease.
The additional pathogen, Monographella maydis, has been thought to be responsible for “fish eye” symptoms that coalesce and cause greater leaf tissue loss.

// WHAT YOU’LL LEARN
• How and when tar spot arrived
• The impacts it has on corn
• How to manage tar spot
• What to expect in the future

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Q. What are the impacts of tar spot?
A. Like other foliar diseases, the impact of tar spot depends on how early infection occurs and how severe the infection is. In many cases this year, initial infections appear to have occurred in June, with secondary infections occurring in July. In some cases, symptoms were extremely severe by August, which may have resulted in premature plant death.

When leaves are severely infected during grain fill, sugars may not be available, and plants may stop filling ears prior to black layer, resulting in an overall loss in kernel weight and yield. Also, when photosynthesis is reduced because of a loss of leaf area, stalks may be cannibalized for sugars, which results in poor standability and lodging.

Throughout the area where tar spot is occurring, there also are a large number of fields that will likely see little to no yield loss because the disease came in late or symptoms did not develop to levels that affect yield. Just because tar spot is present in a field, that does not mean yield is reduced. Likewise, low yields in fields with tar spot may be reduced because of many other stress factors, such as other diseases like gray leaf spot, reduced fertility from loss of nutrients, or loss of stalk integrity.

In some areas, tar spot can be seen rapidly progressing in the corn canopy on dead plant tissue following other disease infection or nutrient stress. Maintaining plant health throughout the season by reducing stress from lack of nutrients or from other pathogen infection could reduce risk of yield loss.

Q. How does tar spot start and spread?
A. The tar spot fungus almost certainly overwinters in infested crop debris, although the exact means of how the fungus overwinters, and the exact way it infects, are not known. At some point, wind-blown or splashing rain likely moves fungal spores from crop debris onto the leaves of the new corn crop, which then becomes infected.

Research from Mexico suggests that the latent period or incubation period (the time it takes from infection to visible lesions) is as long as 40 days. Observations in the United States show that this
TAR SPOT: Symptoms and Management

- Period may be only 12 to 15 days under certain circumstances. Like other corn diseases, such as rust, gray leaf spot and northern leaf blight, tar spot is polycyclic, meaning that it can produce many generations of spores and infect the crop within the same season.

**Q. Do infected fields have the second pathogen?**

A. The second fungus, *Monographella maydis*, which is associated with the fish-eye symptoms in central America has not been identified, yet in 2018, in the United States. However, the symptoms have been observed since 2015. Multiple samples with classic fish-eye symptoms have been submitted to various diagnostic labs, but *M. maydis* has not been identified from those samples.

**Q. Does tar spot overwinter here?**

A. It appears to overwinter. Because symptoms have been observed in the same areas since 2015, it seems that the fungus is overwintering rather than being introduced from Mexico or Central America each year. However, a lot more work is needed to learn how it overwinters, where it does so, if it survives on other alternative hosts, etc.

**MANAGEMENT**

**Q. Are there differences in hybrid resistance to tar spot?**

A. While there are no hybrids grown in the U.S. Corn Belt that are known to have high levels of resistance to tar spot, there appear to be slight differences among hybrids in levels of susceptibility. Most hybrids from all companies appear to be relatively susceptible to tar spot, but a few products appear to have slightly less severe symptoms.

Comparing hybrid reactions to tar spot, or any disease in isolation, can be tricky. Multiple side-by-side comparisons in fields with uniform levels of disease pressure are best suited for comparing hybrid reactions. Comparing levels of infection between hybrids in different fields may not be fair because the severity of symptoms depends, to some degree, on when infection occurred, which in turn, depends on the amount of the tar spot fungus that overwintered in infested corn debris in a field. Fungicide applications, neighboring fields with high amounts of inoculum, or uneven levels of tar spot infection throughout a field might also complicate comparisons.

**Q. Does rotation help manage tar spot?**

A. Rotation should not make tar spot any worse, but it may not provide much control. Because the fungus appears to overwinter in infested debris, avoiding that inoculum early in the season should be of some benefit depending on how much inoculum is available from other sources (e.g., neighboring fields) and how far the spores spread. Based on the widespread occurrence of tar spot in 2018, the fungus appears to be able to spread very rapidly over long distances when weather is favorable. In years with less favorable weather, rotation or management of infested debris may be of more value in limiting the development of tar spot.

**Q. Do fungicides help control the disease?**

The overall assessment is that fields treated with a fungicide are better than those without. However, some fields sprayed with a fungicide still suffered some yield loss and standability concerns. It is unclear whether these applications were too late, too early or simply not frequent enough to control the disease. It is also possible that because we are
**TAR SPOT: Symptoms and Management**

The photo on the left shows an aerial view of an untreated test strip in an Ogle County, IL field on September 15, 2018. The remainder of the field was treated with Delaro® at 8 oz/acre. The photo on the right shows ears harvested from the untreated test (left) and the ears which received Delaro treatment (right).

**Q. Do fungicides help control the disease?**

The overall assessment is that fields treated with a fungicide are better than those without. However, some fields sprayed with a fungicide still suffered some yield loss and standability concerns. It is unclear whether these applications were too late, too early or simply not frequent enough to control the disease. It is also possible that because we are dealing with a new pathogen in combination with some susceptible germplasm, when experiencing a perfect environment, one application could simply not be enough. Farmers, retailers and seed companies are used to working with products with respectable tolerance to many foliar diseases. With low tolerance to a disease, very susceptible crops historically have required multiple applications of fungicide to prevent yield loss. At this point, we can’t say what the right answer is, but we’re working on it. The combination of fungicides with more tolerant products will likely be the best means of help in the near term.

Delaro® applied at 8oz/A, with 2 GPA when applied aerially, or 10 GPA when applied by ground at VT-R1 timing is labeled for control of key Midwestern diseases, such as gray leaf spot, northern corn leaf blight, rust, and tar spot. Tar spot is currently labeled under a 2(ee) for Illinois, Indiana, Iowa, Michigan, Ohio and Wisconsin.

**Q. Will we have tar spot again next year?**

A. Tar spot has occurred in northern Illinois and Indiana each year since it was first discovered in 2015. Levels of severity have varied depending on weather and other factors. Considering the amount of corn debris infected with tar spot that will remain in fields after harvest in 2018, inoculum is likely to be abundant over a wider geographic area than in any of the three previous years. However, infection of the 2019 corn crop by tar spot will largely depend on weather conditions that are favorable to the development of the disease.

For instance, in La Salle County, Illinois, in 2015, harvest time levels of tar spot were quite noticeable. By 2017, levels were extremely low. Environmental conditions in 2016 and 2017 likely played a role in this reduction, and the same thing could happen in the future.

We are monitoring current and historical weather conditions to better understand risk and frequency of possible occurrence, particularly in the affected states of Illinois, Indiana, Iowa, Michigan, Ohio and Wisconsin.

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