Corn & Soybean News

July 2024
Volume 6, Issue 07

Martin-Gatton College of Agriculture, Food and Environment | Grain and Forage Center of Excellence

Preparing Western Kentucky for Southern Rust in Corn

Dr. Kiersten Wise, UK Extension Plant Pathologist

Western Kentucky will receive rainfall from tropical storm Beryl this week and there are concerns that this storm will bring with it an unwanted disease, southern rust of corn, caused by the fungus *Puccinia polysora*. This fungus does not overwinter in Kentucky and spores blow north each year on wind and storms.

The disease has developed slowly in southern states this year, but has been confirmed in Texas, Louisiana and southern Arkansas, as well as Georgia so far in 2024. Confirmed disease can be observed on the cornipmpipe website. On the map, red counties/parishes indicate that southern rust has been confirmed by university/Extension personnel. The track of the tropical storm skirts most areas with confirmed disease, so it is not expected that large amounts of spores will move north on the storm. We also would need favorable conditions for disease to develop if spores are deposited in western Kentucky. **We typically confirm southern rust in Kentucky in mid-July each year**, depending on weather conditions, so if southern rust is observed in the coming weeks, it would not be abnormal. If southern rust is suspected, the fastest way to get a diagnosis through the Plant Disease Diagnostic Laboratory (PDDL) is to submit samples through County Agents.

It will be important to scout and monitor fields over the next few weeks and submit samples to the PDDL through local County Extension Agents if you suspect you have southern rust in a field. Tips on identifying southern rust can be read in a previous article. The potential impact of southern rust in Kentucky will depend on the crop growth stage of a field once southern rust is confirmed in an area.

Previous research from southern states indicates that fungicides may be needed to protect yield while corn is in the tasseling through milk (VT-R3) growth stages. Once corn is past milk (R3), fungicides are likely not needed to manage the disease. If fields have already received or will soon receive a fungicide application this year at tasseling/silking (VT/R1), they are not likely to need a second application of fungicide once corn reaches the blister (R2) growth stage. For areas where planting was significantly delayed, careful scouting and monitoring for disease presence is key to determining if or when a fungicide will be needed for southern rust management.

More information on timing of fungicide applications for southern rust can be found in Table 2 of the Crop Protection Network publication on Southern Rust. The efficacy of specific fungicide products for southern rust are described in the updated fungicide efficacy table for management of corn diseases, which is developed by the national Corn Disease Working Group.

Optional Citation: Wise K. 2024. Preparing western Kentucky for southern rust in corn. *Corn & Soybean News,* Vol 6, Issue 7. University of Kentucky, July 12, 2024

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Foliar Fungicide Considerations for Soybean

Dr. Carl Bradley, UK Extension Plant Pathologist

As full-season soybean fields in Kentucky approach the R3 (beginning pod) developmental stage, it generally is a time to consider an application of a foliar fungicide to protect against foliar diseases. Rainfall is an important factor to consider when making a foliar fungicide application decision, as high rainfall accumulation is one of the main drivers that can increase the risk of foliar diseases. Besides rainfall, the risk of foliar diseases also is affected by other factors such as the soybean variety planted, and the cropping history in a field.

Figure 1. Symptoms of frogeye leaf spot on soybean leaves (Photo by C. Bradley).

The primary foliar diseases of concern that have shown the ability to cause economic yield losses in Kentucky recently are frogeye leaf spot (Fig. 1) and target spot (Fig. 2). Both diseases are influenced greatly by the soybean variety being grown. Some varieties are highly resistant to frogeye leaf spot, while others may be susceptible; therefore, it is important to be aware of the disease ratings of the varieties planted in your fields. Target spot is a relatively new disease to Kentucky and did have a large impact on soybean yields on a few limited fields on very susceptible varieties a few years ago. More recently, it appears that fewer varieties have high susceptibility to this disease, which helps reduce the risk of target spot. Regardless, it is still important to continue scouting for this disease, as information on specific varieties' susceptibility to target spot is limited.

Figure 2. Symptoms of target spot affecting a soybean leaflet (Photo by C. Bradley).

Other foliar diseases that generally do not have an economic impact on soybean but can in certain years are Septoria brown spot (Fig. 3) and Cercospora leaf blight (Fig. 4). In general, symptoms of

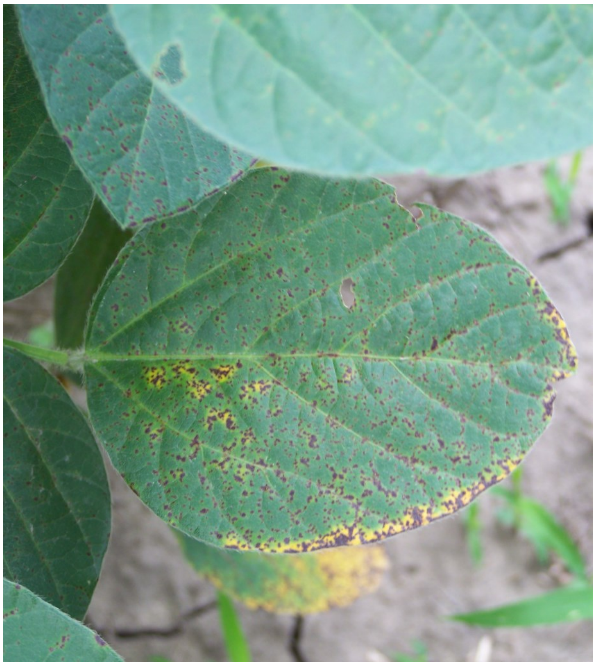

Figure 3. Brown lesions and yellowing on the leaf edges caused by the Septoria brown spot pathogen of soybean (Photo by C. Bradley).

Figure 4. "Purpling" of soybean leaf caused by the Cercospora leaf blight pathogen (Photo by C. Bradley).

Septoria brown spot often are only on leaves in the lower canopy, which has little impact on yield. However, in years with frequent rainfall throughout the season, spores of the Septoria brown spot pathogen may splash up to the upper canopy and cause some upper leaves to prematurely defoliate. When this happens, some yield loss can be attributed to Septoria brown spot. Although Cercospora leaf blight may occur in Kentucky, the appearance of this disease generally has been later in the season, which often has been too late to cause yield reductions.

A soybean disease "score card" is available in the resources section of the Take Action website (https://iwilltakeaction.com/), that is titled, "Know Your Disease Risk in Soybeans: What's Your Score?". This score card can be used on a field-by-field basis to help determine what the risk is for foliar disease development and can help make fungicide application decisions.

If the decision is made to apply a foliar fungicide, it is important to choose a product that has efficacy against the spectrum of diseases that might affect your field. It is also important to choose a product that contains multiple modes of action to help manage the potential of fungicide resistance. Isolates of the frogeye leaf spot, Septoria brown spot, target spot, and Cercospora leaf blight pathogens that are resistant to strobilurin (quinone outside inhibitors, "QoI", FRAC Group 11) fungicides are present in Kentucky, so fungicide resistance is an important consideration. To help make a decision on which fungicide products might work best for the diseases you intend to manage, the "Fungicide Efficacy for Control of Soybean Foliar Disease" publication on the Crop Protection Network (https://cropprotectionnetwork.org/) can provide information that will help with that decision.

Optional Citation: Bradley C. 2024. Foliar Fungicide Considerations for Soybean. *Corn & Soybean News,* Vol 6, Issue 7. University of Kentucky, July 12, 2024

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Carbon Dioxide -The Gas that Feeds Us and Could Kill Us!

Dr. Dennis Egli, UK Professor Emeritus

Carbon dioxide (CO_2) currently makes up about 0.042% (420 ppm) of the atmosphere - a minuscule concentration in comparison with oxygen (21%) or nitrogen (78%) - but it is the key to all life on earth. Carbon dioxide is the source of all of the food that sustains us, while, on the other hand, this gas is widely reviled as a greenhouse gas that is causing climate change that could eventually kill us. Ironically, it is also the source of all of the fossil fuels (coal, petroleum and natural gas) we have been burning for the last several centuries. A classic case of the good, the bad, and the ugly wrapped up in a single gas. Let's untangle this complicated situation, starting with the 'good' – its role in providing our food.

Carbon dioxide in the atmosphere is the source of our entire food supply. Plants use energy from the sun to convert CO_2 into simple sugars via photosynthesis. Plants can transform these simple sugars into complex carbohydrates, protein (with N), fats and oils that make up the food we eat. Some of these plant products are fed to animals to provide us with meat, milk and eggs.

Of course, food production requires other inputs (N,P, K, micronutrients, water) and favorable temperatures, but C from CO_2 is the fundamental ingredient. We couldn't have our morning coffee or a hamburger for lunch (along with the beer to wash it down) if it wasn't for the CO_2 in the atmosphere.

The 'bad' face of CO_2 is its role as a greenhouse gas that causes climate change. Radiation from the sun warms the earth's surface which cools by emitting long-wave radiation that we can't see. Greenhouse gases (CO_2, methane, nitrous oxide and water vapor) in the atmosphere absorb some of this long-wave radiation and reradiate back to the earth's surface, reducing the amount of cooling. The greenhouse gases essentially act like a blanket thrown over the earth. The thicker the blanket, (the higher the greenhouse gas concentrations) the warmer the earth.

The term 'greenhouse' is used because these gases act just like the glass on a greenhouse. The glass lets solar radiation pass through, but it absorbs the long-wavelength radiation from the benches and plants in the greenhouse, so the greenhouse gets hot, just like the earth.

Scientists first realized that CO_2 was a greenhouse gas in the early to mid- 1800s. At that time, some of them predicted that continuing to put CO_2 into the atmosphere by burning fossil fuels (mostly coal then) would eventually increase temperatures.

Atmospheric CO_2 concentrations in 1800 were about 280 ppm, but burning coal and petroleum products has increased it to around 420 ppm today – concentrations the earth hasn't seem for 3 million years.

While we worry a lot about the effects of the enhanced greenhouse effect and climate change, the truth is we depend upon CO_2 in the atmosphere to make the world habitable. The earth would be too cold to support life if there were no greenhouse gases in the atmosphere. Life on earth depends on that blanket, but it can't get too thick. A classic exception to the old saying – if a little is good, more is better.

Ironically, the root cause of our problems with global warming traces back to the photosynthetic fixation of carbon that also feeds us. The fossil fuels that are increasing the CO_2 in the atmosphere originated from photosynthesis and plant growth. Plant remains were buried under sediments and over millions of years were turned into coal and petroleum. The energy in coal and petroleum came, originally, from photosynthesis and CO_2 in the atmosphere. Now we are returning it to the atmosphere where it is causing climate change. This might seem like harmless recycling but deposits that accumulated over millions of years are being turned into CO_2 in just a few years and atmospheric concentrations are going up.

The story of CO_2 is a story with many twists and turns. We have known for more than 200 years that increasing the CO_2 concentration in the atmosphere would warm the earth and now we are starting to see the effects – not just higher temperatures, but droughts (and the fires that come with them), floods and an increase in severe storms. On the other hand, greenhouse gases make the earth habitable, and CO_2 feeds us. Talk about a dual personality - the gas that feeds us may also end up killing us if we don't eliminate our use of fossil fuels.

"We are like tenant farmers chopping down the fence around our house for fuel when we should be using Nature's inexhaustible sources of energy – sun, wind and tides. … I'd put my money on the sun and solar energy. What a source of power! I hope we don't have to wait until oil and coal run out before we tackle that" (Thomas Edison, inventor, 1847 – 1931).

Optional Citation: Egli, D. 2024. Carbon Dioxide -The Gas that Feeds Us and Could Kill Us! *Corn & Soybean News,* Vol 6, Issue 7. University of Kentucky, July 12, 2024

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Corn Water Demands During a Kentucky July

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Nearly half of the Kentucky corn crop is silking. All of that silking corn is at maximum water demand. Silking corn is at greatest risk to yield losses from a lack of water. Soil moisture and rainfall over the next 10 days in Kentucky will go a long way to making or breaking the 2024 corn crop.

As of July 7, about 46% of the corn is silking and 12% is at the milk stage (Knopf, 2024). Corn at silk (R1 growth stage) uses around 0.30 to 0.32 inches of water per day, while corn that at milk (R3 growth stage) uses about 0.28 inches of water per day (Abendroth et al. 2011 and Kranz et al. 2008).

Corn at tasseling and silking is at maximum water demand, and maximum sensitivity to water stress. Photo by Celeste Nye.

The subsoil values were similar. Those soil moisture values likely re-flect the rainfall last week. Many plac-es received at least an inch of rain last week and corn in these areas is in de-cent shape. These places include Hop-kinsville, Owensboro, Elkton, Morgan-field, Munfordville, Bowling Green, Somerset, and Louisa all received at least an inch of rain. Other places re-ceived 0.5 inches or less, and corn is at risk of drought stress. These places include Benton, Paducah, Elizabeth-town, Hardinsburg, Albany, Lexington, Richmond, Jackson, and Harlan. About 68% of all topsoil was rated as having "adequate moisture" while 22% of topsoil was "short" and 7% were "very short" on moisture (Knopf, 2024).

Drought stress often first appears with rolled leaves and a slightly gray color to the leaves. Leaf rolling helps reduce water losses, but also reduces photosynthesis. Drought stress on corn about 7 to 10 days prior to silking can result in delays in silk emergence and corn plants shedding pollen too soon. A single plant will release pollen for about 7 days and a field of corn will release pollen for a little longer. In severe cases, pollination can be severely reduced. Drought stress after pollination could abort some of the new kernels by blister stage. Visible signs of drought stress from pollination to the blister stage can result in about 3 to 9% yield losses for each day of drought stress (Quinn, 2022).

If your fields are in areas of the state with adequate soil moisture and over an inch of rain last week, rest a little easy. The crop is in good shape. If your fields are in the "short" and "very short" categories and/or those fields received less than 0.5 inches of rain the last week, keep an eye on these fields. The corn crop is going to have some challenging days until they get needed rain.

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Optional Citation: Lee, C. 2024. Corn Water Demands During a Kentucky July. *Corn & Soybean News,* Vol 6, Issue 7, University of Kentucky, released July 12, 2024

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Dr. Shamim Joins University of Kentucky as Grain Crops Agronomic Extension Associate

Dr. Mohammad Jan Shamim has begun his role as a Grain Crops Agronomic Extension Associate at the University of Kentucky, under the guidance of Dr. Chad Lee. In this position, Dr. Shamim will engage in extension activities, consulting with county extension agents, farmers, and crop scouts and addressing their challenges. He is excited to be working with the broader Extension team at the University of Kentucky. Dr. Shamim has extensive experience in soybean physiology. He earned two advanced degrees and completed one year of a postdoctoral study in various aspects of soybean physiology. Originally from Afghanistan, Dr. Shamim holds a master's and a Ph.D. from Kyoto University, Japan. During his master's program, he focused on the physiological mechanisms of leaf photosynthesis, growth, and yield in wild-related soybean progenies. For his doctoral research, he conducted an in-depth physiological analysis and explored the genetic architecture of leaf photosynthesis within the Japanese soybean germplasm. His work emphasized leveraging photosynthetically promising accessions, landraces, and wild-related materials, driven by the belief that continuous breeding for improved morphological traits has narrowed soybean's genetic diversity. Dr. Shamim posited that tapping into this unexplored gene pool could significantly enhance our understanding of soybean photosynthetic capacity.

After earning his doctoral degree in September 2022, Dr. Shamim joined Dr. Salmeron's Lab at the University of Kentucky as a postdoctoral researcher. He contributed to three key projects: In his first project, he evaluated the combined impact of winter cover crops and late-season nitrogen fertilizer applications on soybean biomass accumulation, seed quality, and biological nitrogen fixation. In the second project, he assessed the sensitivity of crop growth, evapotranspiration, and water use efficiency across nine crop simulation models under varying rainfall gradients and climate change scenarios. Lastly, he contributed to a study that assessed the sensitivity of multi-model simulations of changes in biomass and yield under elevated carbon dioxide conditions.

During his tenure at Kyoto University and his graduate studies at the University of Kentucky, Shamim also gained extensive experience in data analysis, research design, statistical methodologies, and scientific communication.

Dr. Shamim is passionate about academia and bridging the gap between academic research and practical agricultural applications. He is dedicated to ensuring that academic and experimental innovations directly benefit growers, making a tangible impact in the field.

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Soybean Water Stress in Kentucky

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Twenty-seven percent of soybeans are "blooming" (R1 and R2) and 6% of soybeans are setting pods (R3 and R4) CW070824.pdf (usda.gov). Those soybeans at pod stages will be moving into R5 (beginning seed) and R6 (full seed) over the next couple of weeks. Soybeans are more sensitive to water stress during reproductive stages compared to pre-blooming stages. For instance, water stress at the blooming stage is reported to decrease seed yield by 9-13%. In contrast, water stress at the R4 (full pod) and R5 (beginning seed) stages is more devastating and can lead to yield losses ranging from 28% to 71% (Eck, et al., 1987; Dogan et al., 2007; Karam et al., 2005; Ogunkanmi et al., 2022).

If irrigation is an option for your soybeans at the R4 growth stage or later, it is crucial to irrigate now. Soybean plants yielding around 40-50 bushels per acre will need approximately 20-25 inches of soil moisture over the growing season. Although water use varies depending on the growth stage (Table 1), it is essential to monitor evapotranspiration demand and soil moisture sensors, adjusting the water amount accordingly. Your irrigation system should be capable of delivering up to 15 inches of water throughout the season to supplement rainfall and ensure the soybeans get enough water. For double-crop or late-planted soybeans, pre-bloom irrigation is crucial for good plant development. Regularly scout your fields for signs of water stress. One indicator is soybean leaves staying upright late in the afternoon, which suggests the plants are stressed for water. However, waiting until you see these visual stress signals to irrigate can lead to yield loss (Tacker, 2000).

Installing tensiometers in fields can help better schedule irrigation and avoid stress. In this case, irrigation is recommended when the reading is 50-60 centibars in silt loam, silty loam, and clay soils, and 40-50 centibars in sandy soil. Tensiometers should be installed at 8 inches deep in center-pivot systems. If the tensiometer method is a challenge, the touch-and-feel method could help. Simply dig the soil close to the root using a shovel and a soil probe and form a hand-rolled ball. If the soil forms a ball, the soil moisture is adequate. It is important that you take samples from various parts of the fields and if irrigation is needed, irrigate the entire field (Tacker, 2000).

Table 1: Soybean growth stages and daily water use

Crop development	Water use (inch/day)
Germination and seedling	0.05-0.1
Rapid Vegetative Growth	0.10-0.2
Flower to Pod-fill (full Canopy)	0.02-0.3
Maturity to Harvest	0.05-0.2
Source: Tacker, (2000)	

If irrigation is not a possibility, certain management practices could mitigate the yield loss. For instance, pests can intensify the water stress experienced by the soybeans. Weeds are especially competitive for water in a dry year and should be removed immediately with herbicides. The prevalence of insects and fungal diseases could exacerbate the yield loss, therefore, proper scouting of the field for insects and disease from July to late September is important. Insects not only suck water and nutrients from plants, but they also cause defoliation. A controlled environment study in North America has shown that drought and insects can cause a 10-45% reduction in soybean above- and below-ground biomass (Grinnan et al., 2013). For more information about the economic threshold that triggers insect control, please visit the University of Kentucky guidelines at https://entomology.ca.uky.edu/files/ent13-soybeans.pdf.

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Martin-Gatton College of Agriculture, Food and Environment

July 23, 2024

Corn, Soybean & Tobacco Field Day

UKREC, Princeton KY 42445

Wagons roll: 8:00am CT

Topics include:

Corn Disease Concerns For 2024
Familiar and New Soybean Diseases to Look Out for in 2024
Insect Update
Corn and Soybean Variety Trials
Weed Control in 2024 And Beyond
“Weather Alert”
Maximizing Corn Yields Following a Cover Crop
Soybean yield and economic response to irrigation
Corn and Soybean Outlook
The Fundamentals of Soil pH Management for Production Agriculture
Changes To Agr-1 Fertilizer Rate Recommendations for Kentucky Grain Crops
UKREC Dark Tobacco Infrastructure and Research Update
Tobacco Research Update from University of Tennessee
Sulfur Fertility in Tobacco

Registration: http://tiny.cc/m9jlyz Or scan the QR Code

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