Corn & Soybean News

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

2024 Has Been a Wild Ride for Crop Farmers in Kentucky

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Dr. Mohammad Shamim, Grain Crops Agronomic Extension Associate

Some farmers across Kentucky will see their best crop ever in 2024 and other farmers are going to see one of the worst ever. The rest will fall somewhere in between. The varied rainfall timing and accumulations of rainfall caused tremendous variability across the state. This is not the best year to judge your farming skills in corn and soybeans across Kentucky. Every farmer wants to control as much as possible, but 2024 is a strong reminder of how dependent all of us are on the weather.

The rainfall totals in 2024 are in stark contrast to many counties in 2023. In general, farmers experienced significantly lower rainfall in July and September 2024 compared to the same months in 2023 (Figure 1). For instance, in July 2023, most counties received approximately 6 inches of rainfall, whereas in 2024, only some counties in far western Kentucky and a few counties in far eastern Kentucky (where few corn and soybean acres are grown) experienced substantial precipitation. Similarly, farmers received 5 to 6 inches of rainfall in August 2023, but no measurable rain-

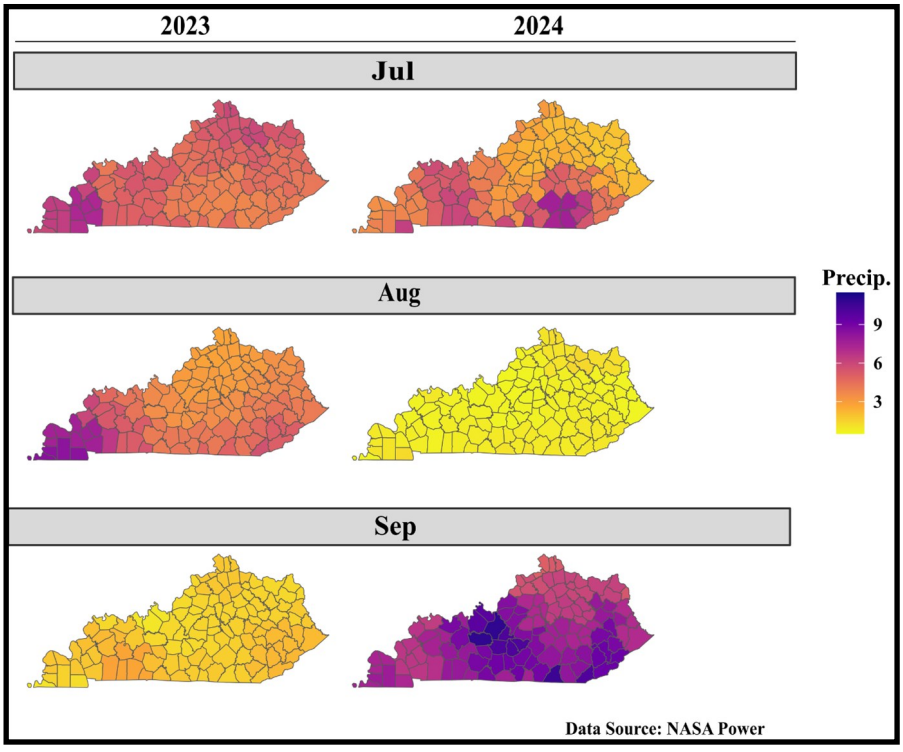

Figure 1: Precipitation from July to September in Kentucky for 2023 (left) and 2024 (right). Data sourced from NASA and county maps generated by Dr. Mohammad Shamim with R analysis program.

fall occurred in August 2024, making it one of the driest months. In contrast, while September 2023 saw little to no rainfall, September 2024 experienced over 6 inches of rain, with some counties reporting totals as high as 12 inches. For many fields, that September rain was too late to help.

Rainfall totals for 2024 from western Kentucky to eastern Kentucky help explain the expected differences in yields. In general, farmers in western Kentucky received more rainfall than farmers in central and eastern Kentucky. From April to September, the Ballard County Kentucky Mesonet site reported 36 inches of rain while Hardin and Boyle counties received about 9 inches less (Figure 2). Boone County Kentucky Mesonet only received 23 inches. The total rainfall only tells part of the story.

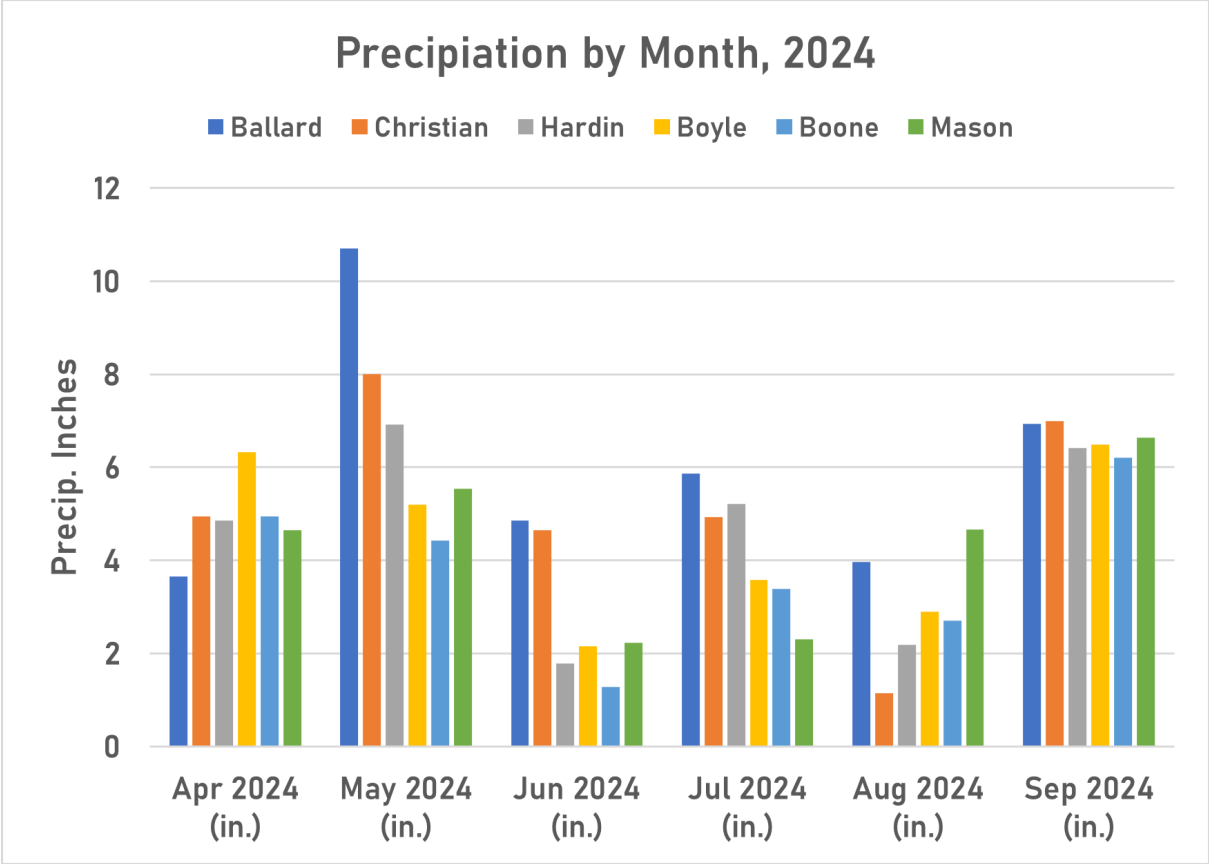

Figure 2. Precipitation by month from Kentucky Mesonet sites in selected counties. The order of counties listed is from west to east.

The timing of rainfall is as important as the rainfall totals. Rainfall in July and August is extremely important to yield of corn and soybean in Kentucky. Ballard County in 2024 received almost 10 inches of rainfall while Hardin County received 7.4 inches of rain (Figure 3). All other counties listed here received less than 7 inches of rain. Seven inches usually is not enough water to sustain corn during peak demand. If soils have adequate water heading into July, they can buffer against lower rainfall. The western Kentucky sites also reported more rainfall in May and June. Fields in those counties were better prepared for peak water demands.

The differences in rainfall between 2023 and 2024 help explain the differences in yields. Pollination, seed-set and seed fill usually occur over these two months. Drought stress during these months can significantly impact fertilization and pollination. While rainfall totals for July and August were less than 7 inches for most locations listed in Figure 3, the Irrigation Manager on the UK Ag Weather Center website estimates that water demands were greater than 11 inches this year. Rainfall in July should have been adequate for seed-set in early-maturing or early-planted corn and soybeans. However, the dry conditions in August likely disrupted the source-to-sink balance, contributing to the development of smaller and/or shriveled seeds. In contrast, the lower productivity observed in double-crop soybeans may be attributed to poor pollination, seed-set, and seed fill as these stages coincided with the onset of drought.

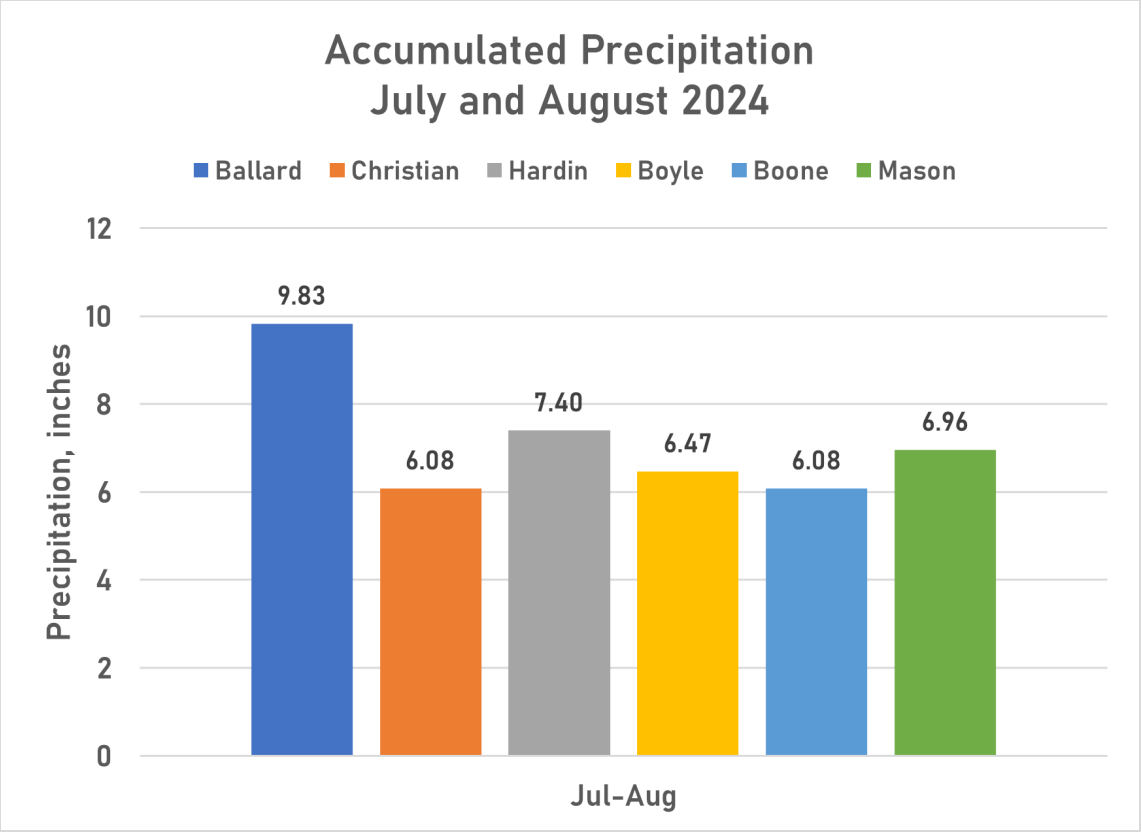

Figure 3. Precipitation totals for July and August from Kentucky Mesonet sites in selected counties. The order of counties listed is from west to east.

Limited water availability has detrimental effects on crop reproductive development. Unlike animals, plants cannot move to avoid drought stress. Instead, they reduce water-consuming processes. For example, when drought occurs, plants reduce stomatal aperture to conserve water, which decreases carbon dioxide (CO_2) intake and consequently limits the photosynthetic supply to flowers, pods, and seeds. In some cases, lower CO_2 levels cause the enzyme Rubisco to bind Ribulose 1,5-bisphosphate to oxygen gas (O_2), a process known as photorespiration, leading to a net loss of sugar substrates.

Additionally, drought stress can trigger the formation of reactive oxygen species, which can permanently damage the photosynthetic system. As a result, the sugar supply to seeds diminishes, leading to smaller or shriveled seeds. Furthermore, in soybean, reduction in photosynthesis means lower supply of sugar to symbiotic rhizobium bacteria which down-regulates biological N fixation. Drought stress significantly affects the transport of water and nutrients in plants. Water transport is driven by the negative water potential of the atmosphere, which is much stronger than the water potential in the root zone. This considerable force can sometimes lead to cavitation in the xylem vessels, resulting in reduced metabolic functions, impaired nutrient uptake, and overall stunted growth.

This article has shown that a lack of water during pollination, seed-set and/or seed-fill has numerous deleterious effects on corn and soybean yield. The yield this year is not a reflection of farming skill. We simply cannot grow a good crop when water is so limited.

Optional Citation: Lee, C., Shamim, M. 2024. 2024 Has Been a Wild Ride for Crop Farmers in Kentucky. *Corn & Soybean News, Vol 6, Issue 11.* University of Kentucky, November 15, 2024.

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Climate Change and Agriculture

Dr. Dennis B. Egli, UK Professor Emeritus

Stories of climate disasters dominated the recent news – too much water, not enough water, high temperatures and hurricanes. Are these disasters a preview of the future?

It is difficult to attribute any specific weather event to climate change, after all we had droughts, floods and hurricanes long before we started worrying about climate change. Some argue that extreme weather events are just fluctuations in the weather, implying that normal conditions will return in the future. We all know that weather fluctuates from day-to-day and year-to-year, but the climate change occurring today is not a random fluctuation, it's real.

Climate change is driven by the greenhouse effect – greenhouse gases in the atmosphere (carbon dioxide, methane, nitrous oxides, and water vapor, of which carbon dioxide is the most important) act like a blanket over the earth, increasing temperature. The higher the concentration of greenhouse gases, the thicker the blanket, and the warmer the earth. Carbon dioxide concentrations in the atmosphere have increased from 280 ppm at the dawn of the industrial revolution in the early 1800s to more than 420 ppm today.

In all the debate about climate change, I have never heard anyone argue that the greenhouse effect, first discovered in the early 1800's, is not real. The greenhouse effect is increasing global temperatures (2023 was the hottest year in NOAA's 174-year record of global temperatures) which will, in turn, affect all aspects of our weather, but we can't predict exactly what the effect will be. We can, however, draw some general conclusions about how climate change might affect our grain-cropping systems.

Let's take the good news first. Higher levels of carbon dioxide in the atmosphere increase photosynthesis of crops that have C3-type photosynthesis (most crop species including soybean, wheat, rice canola and many forage species) which will increase their yields, unless other aspects of the environment are limiting. Unfortunately, plants with C4-type photosynthesis (corn, sorghum and millet) do not respond to higher carbon dioxide levels.

And now for the bad news. Temperatures above the optimum for plant growth will reduce photosynthesis and growth, which will, in turn, reduce yield. Really high temperatures interfere with pollination and seed set which can have catastrophic effects on crops where the seeds are harvested for yield (i.e., grain crops).

Plants growing in higher temperatures will mature sooner and probably have shorter seed-filling periods. Shorter seed-filling periods produce smaller seeds and lower yields. Crops growing in environments where temperatures are below the optimum might benefit from rising temperatures until the temperatures pass the optimum.

It's very likely that future crops will experience more water stress - too little or occasionally too much – as a result of climate change. Warm air holds more water vapor so we can expect more extreme, high-intensity rainfall events (think about hurricane Helene and western North Carolina) as temperatures increase.

Higher temperatures increase crop water use making it more likely that crops will run out of water during the growing season, thereby reducing yield.

Higher temperatures could change weather patterns and cause reductions in rainfall and drought (think about the long-term drought and water scarcity problems in California).

While we don't know exactly how the weather and climate will change, there is no doubt, unless you claim that the greenhouse effect doesn't exist, that the earth is warming, and our weather is changing. Can we adjust our crop production systems to minimize effects of climate change on food production?

Warmer temperatures mean that the growing season will be longer, which will open areas at higher latitudes, where temperatures may be lower, for grain crop production. Longer growing seasons will also increase opportunities for double cropping. Growing soybean after winter wheat, common in Kentucky, has now spread to Northern Ohio and even Michigan.

The longer growing season may make it possible to adjust planting dates and variety maturity (using earlier varieties with shorter growth cycles) of corn and soybean to minimize the effect of climate change by avoiding the highest temperatures and/or drought-prone periods (think about the success of the Early Soybean Production System (ESPS) - early varieties, planted early- in the Mid-South).

Plant breeders and geneticists are working to develop varieties that are more tolerant to high temperatures and moisture stress. Other scientists have suggested using crops that are not currently widely grown but have tolerance to high temperatures and water limitations (sorghum and millets for example).

These options may reduce the effects of climate change on crop productivity, but it is unlikely that they will provide long-term solutions. Adjusting to small increases in temperature or reductions in rainfall may be possible, but I don't think we can manage our way around really catastrophic changes in the weather. For example, even drought tolerant crops can't grow without some water. Managing around long-term catastrophic drought, floods and heat waves, may be difficult.

The only long-term solution to climate change is to abandon fossil fuels, reduce emissions of greenhouse gases to essentially zero and lower the carbon dioxide concentration in the atmosphere to more reasonable levels. This is a huge challenge that will require major changes in agriculture and society, but it must, and it can be done. "Never doubt that a small group of thoughtful citizens can change the world. Indeed, it is the only thing that ever has" (Margaret Mead, anthropologist, 1901 - 1978).

Optional Citation: Egli, D. 2024. Climate Change and Agriculture. *Corn & Soybean News, Vol 6, Issue 11.* University of Kentucky, November 15, 2024.

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Soybean Seed Quality Issues Due to Fungal Infections

Dr. Carl A. Bradley, UK Extension Plant Pathologist

Little rainfall during August and most of September in parts of the state has led to poor soybean pod integrity and earlier than expected maturity. With the rains that the remnants of Hurricane Helene had dropped, along with the warm temperatures, a scenario developed that has led to soybean seeds being infected and contaminated with fungi. Phomopsis seed decay (usually caused by *Diaporthe longicolla*, formerly known as *Phomopsis longicolla*) and purple seed stain (caused by *Cercospora kikuchii* and *Cercospora flagellaris*) generally are the two main culprits of poor-quality seed. Seeds affected by Phomopsis seed decay may appear shriveled, misshapen, and/or chalky white in color (Fig. 1). As the name suggests, seeds affected by purple seed stain will be discolored with purple blotches, or the entire seed may be purple in color (Fig. 2). Purple seed stain may be more prevalent in fields that showed symptoms of Cercospora leaf blight (Fig. 3.). Certain varieties in some areas had severe Cercospora leaf blight develop late in the season this year. The largest economic losses associated with these seed diseases to farmers occur at the grain elevator, when loads of harvested seed may be docked due to "damaged seed". Of the two diseases, Phomopsis seed decay generally causes the greatest reduction in seed germination.

Fig. 1. Symptoms of Phomopsis seed decay on soybean seeds (C. Bradley photo)

Fig. 2. Symptoms of purple seed stain on soybean seeds (C. Bradley photo)

Fig. 3. Soybean leaves affected by Cercospora leaf blight (C. Bradley photo)

The two most common questions that I am receiving about these diseases are: why am I having this problem this year?; and what could I have done to prevent these seed disease issues?

Why am I having this problem this year?

The primary reason why Phomopsis seed decay and purple seed stain occur in a field has a lot to do with the weather that has occurred since soybeans have been at physiological maturity. Fields in areas of the state that have received frequent rainfall since soybeans have been mature have been hit the hardest with seed disease problems. Along with wet weather, the very warm temperatures that the state was experiencing up until recently also helped promote infection by these fungi. The Phomopsis seed decay pathogen is best able to infect seeds after physiological maturity, and the longer that soybeans sit in the field in wet and warm conditions after they are mature, the greater the likelihood of Phomopsis seed decay problems.

What could I have done to prevent these seed disease issues?

Harvesting soybeans as soon as possible after physiological maturity and at optimal seed moisture is the primary way to avoid problems with Phomopsis seed decay and purple seed stain; however, when rainy conditions prevail, seeds take longer to dry down, and harvest becomes delayed. Planting soybean varieties with relative maturity ratings that match your region and your farming operation also may help with a timely harvest. Since these seed pathogens survive in soybean debris, rotating fields with a non-legume crop may help reduce inoculum levels in the field. Since these pathogens also survive on seed, planting bin-run seed may help perpetuate the problem in a field

by continually introducing the pathogen back into the field. Although soybean germplasm lines have been identified with resistance to Phomopsis seed decay, no commercial soybean varieties are marketed as having resistance to this disease, and soybean breeding programs may not intentionally screen their lines for resistance to Phomopsis seed decay. When applied at later growth stages, such as R5 (beginning seed stage), foliar fungicides have been shown to inconsistently reduce Phomopsis seed decay in research trials. Unfortunately, even when reductions in Phomopsis seed decay have occurred with late-applied fungicides, often-times the magnitude of the reduction would not have been enough to prevent levels of disease that would still be discounted at the grain elevator. Overall, the wet and warm harvest season that parts of the state experienced was likely so favorable for infection and disease development, that there was little that could have been done to avoid some losses due to these diseases this year.

Optional Citation: Bradley, C. 2024. Soybean Seed Quality Issues Due to Fungal Infections. *Corn & Soybean News, Vol 6, Issue 11.* University of Kentucky, November 15, 2024.

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2024 KENTUCKY CROP VARIETY TESTING RESULTS

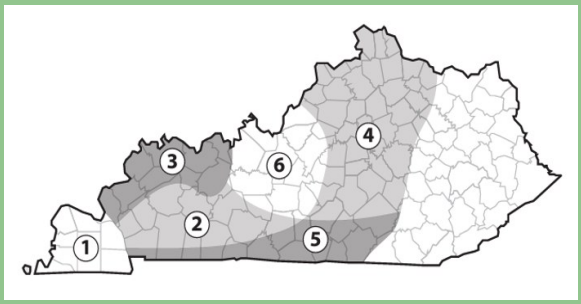
2024 Kentucky Soybean Variety Performance Trials Results

Bill Bruening, Research Scientist III

Richard C. Kenimer, Research Specialist Sr.

NEW - 2024 Kentucky Soybean Variety Performance Report **(.pdf)**

NEW - 2024 Results - Kentucky Soybean Variety Trials **(.xlsx tables)**



2024 KY Soybean Variety Test Sites

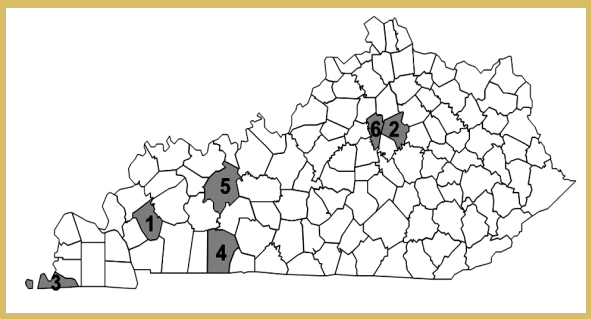
1. Calloway County (Purchase Region1)
2. Caldwell County (West Coalfield Region 2)
3. Caldwell County – Late Planted (West Coalfield Region 2)
4. Daviess County (Ohio Valley Region 3)
5. Fayette County (Bluegrass Region 4)
6. Fayette County – Late Planted (Bluegrass Region 4)
7. Simpson County (Southern Tier Region 5)
8. Woodford County (North Central Region 6)

2024 Kentucky Hybrid Corn Performance Test Results

Richard C. Kenimer, Research Specialist Sr.

2024 Kentucky Hybrid Corn Performance Report (.pdf)

2024 Kentucky Corn Silage Performance Report (.pdf)



2024 Kentucky Hybrid Corn Performance Test Locations.

1. Caldwell County
2. Fayette County
3. Fulton County
4. Logan County
5. Ohio County
6. Woodford County

KENTUCKY YIELD CONTESTS

The Kentucky Extension Yield Contests are administered by the University of Kentucky Cooperative Extension Service. Additional information, contest rules and entry forms for these contests can be found on KyGrains.info or Scan the QR codes below:

2024 Kentucky Corn Production Contest

Send in harvest results within two weeks of the final supervised yield check per individual entry or no later than **December 2, 2024**, whichever is the earlier date.

Contest Classes

A. Division I: Tillage, Non-irrigated

B. Division II: No-Till, Non-irrigated

C. Division III: White Corn, Non-irrigated

D. Division IV: Irrigated Corn

The Kentucky Extension Corn Production Contest and the NCGA Corn Contest are two separate contests.

2024 Kentucky Soybean Production Contest

Forms A, B, & C Must Be ENTIRELY completed and submitted on or before **November 30, 2024** to be eligible for awards.

1. Soybean Yield Contest

A. Full Season - Non-Irrigated

B. Full Season - Irrigated

C. Double Crop - Non-Irrigated

D. Double Crop - Irrigated

2. Soybean Quality Contest (oil and protein)

Martin-Gatton College of Agriculture, Food and Environment

Grain and Forage Center of Excellence

Cooperative Extension Service
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LEXINGTON, KY 40546

Disabilities accommodated with prior notification.

SAVE THE DATE

February 4, 2025

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

KCHC
Kentucky Crop Health Conference

9 a.m. to 3 p.m. CST, Feb. 6, 2025 - National Corvette Museum - Bowling Green, Ky.

Wade Webster
North Dakota State University

Topic: Fueling the Future: Driving Predictive Models for Tar Spot

Alyssa Essman
Ohio State University

Topic: Planting green and the influence of cover crop termination timing on weed management

Justin McMechan
University of Nebraska–Lincoln

Topic: Unraveling emerging insect issues in agriculture: Impacts, challenges, and management tactics

Kiersten Wise
University of Kentucky

Topic: Stay one step ahead: Tracking corn diseases in Kentucky

Raul Villanueva
University of Kentucky

Topic: Management of slugs and snails through field efficacy tests in soybeans

Carl Bradley
University of Kentucky

Topic: Research update on Red Crown Rot of Soybean

Travis Legleiter
University of Kentucky

Topic: The fight against Italian Ryegrass in Kentucky:
A persistent challenge

Tickets on sale now - breakfast and lunch included
Conference sign-in begins at 8 a.m. CST

Scan QR Code or visit: https://kchc2025.eventbrite.com
Tickets non-refundable after January 30, 2025

Credits: CCA: 4.5 CEUs in IPM;
KY Pesticide Applicator: 3 CEUs for Category 1A & 1 CEU for Category 10

UPCOMING EVENTS

2024

Fall Crop Protection Webinar Series
Management of important wheat diseases in Kentucky

November 26, 2024

2025

Kentucky Commodity all Crop Protection Webinar Series
January 16, 2025

Winter Wheat Meeting
February 4, 2025

2025 Kentucky Crop Health Conference
February 6, 2025

Wheat Field Day
May 13, 2025

Pest Management Field Day
June 26, 2025

Corn, Soybean & Tobacco Field Day
July 22 or July 29, 2025

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