Kentucky Field Crops News

Spanning 5 departments and 120 counties

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

UK Wheat Science Group
UK Corn & Soybean Science Group

In This Issue

Tracking Important Corn Diseases

Dr. Kiersten Wise, Extension Plant Pathologist

On July 10, southern rust was confirmed in Crittenden County at low levels. Southern rust typically arrives in Kentucky in mid-July, and whether a fungicide will be needed to manage southern rust will depend on the crop growth stage at the time it is detected in an area. Fungicide applications may be needed to manage southern rust through the milk (R3) growth stage, **although if corn receives a fungicide application at VT/R1, it is less likely to need additional applications if southern rust arrives after VT/R1.** Southern rust can be tracked on a map on the Crop Protection Network. On the map, red counties/parishes indicate that southern rust has been confirmed by university/Extension personnel.

Tar spot has been found across the Midwest but not yet confirmed in Kentucky. Even if tar spot is detected in the state, we would not expect the disease to develop quickly, because risk of disease development is very low, according to the new Crop Risk Tool, that can forecast disease risk for tar spot and gray leaf spot for corn that is between growth stages V10 and R3. **Model predictions for multiple areas in western Kentucky for July 6 through July 13 indicate that corn at V10 or later is at very low risk for tar spot development** (Figure 1). This is not surprising with the high humidity and high temperatures, which are not conducive for the tar spot fungus. Risk for gray leaf spot development is uniformly high across most of Kentucky. In most cases, applying a foliar fungicide once at tasseling/silking (VT/R1) is the most effective way to prevent yield loss from foliar diseases like tar spot and gray leaf spot and offers the greatest potential for a positive return on investment (ROI).

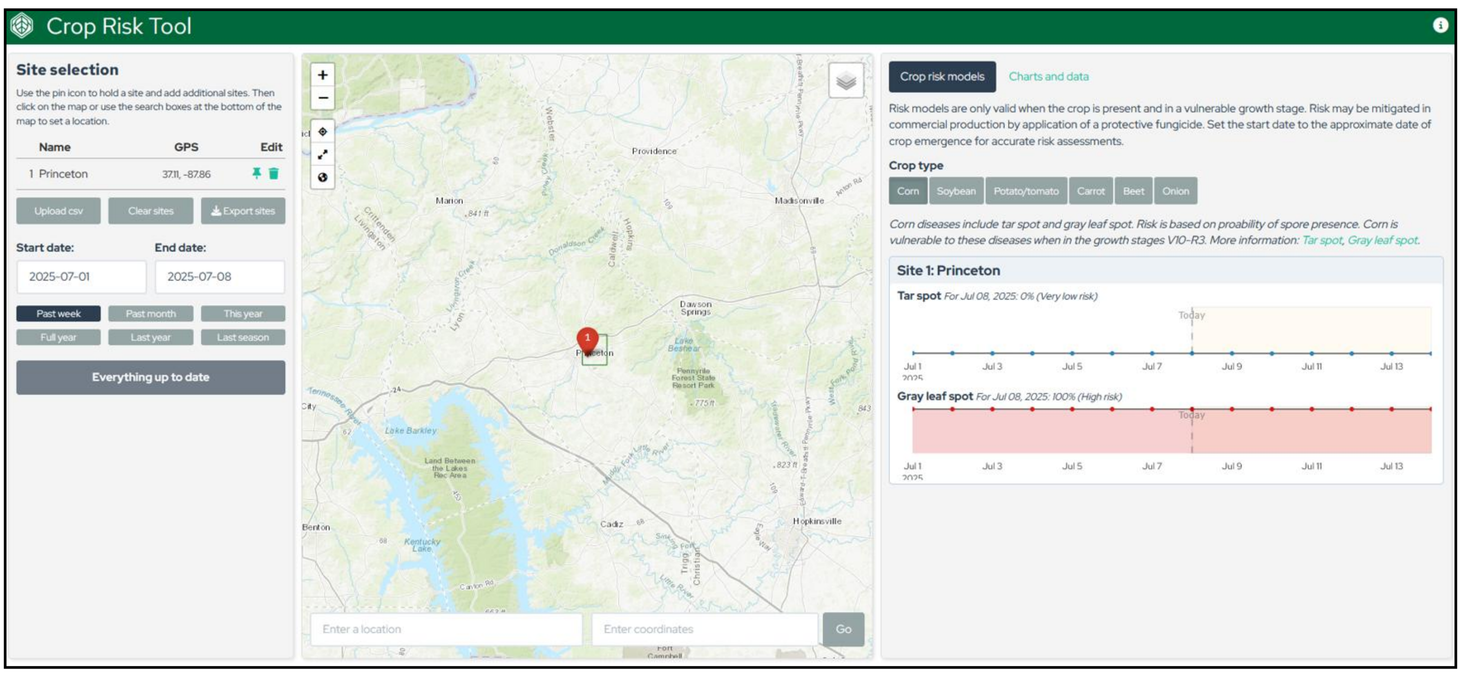

Figure 1. Example of Crop Risk Tool model prediction for gray leaf spot and tar spot risk for Princeton, KY from July 7-13, 2025.

Tar spot can be easily confused with insect frass, which is plentiful in corn at this time of year. Tar spot lesions are raised and feel bumpy on the leaf surface and often are surrounded by a small brown or tan halo (Fig. 2). Insect frass will not have a halo or margin surrounding the lesion, and should wash off with water. Always submit suspected tar spot samples to your County Agent for submission to the Plant Disease Diagnostic Laboratory for confirmation.

Figure 2. Tar spot lesions (left) and insect frass (right) on corn leaves (Photos: Kiersten Wise).

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Dr. Kiersten Wise, UK Extension Plant Pathologist

(859) 562-1338 Kiersten.wise@uky.edu

How Soybeans Respond to Drought Stress: Insights from 2024's Dry Spell

Dr. Mohammad Shamim, UK Grain Crops Extension Associate
Dr. Dennis B. Egli, UK Professor Emeritus

Drought or moisture stress is one of the most critical factors affecting crop yield. A vivid reminder of this was the dry spell of August 2024, where a prolonged lack of rainfall hit the soybean crop during one of its most vulnerable growth periods of seed filling, leading to shriveled, malformed seeds, and in many cases, seed abortion and reductions in yield.

In this article, we explore both short- and long-term coping mechanisms of soybean to drought stress, focusing on how these responses vary across growth stages.

Soybean plants absorb water through their roots and transport it upward through xylem tissues to the leaves, where it eventually evaporates into the atmosphere, a process known as transpiration. This upward movement is driven by atmospheric demand for water, which is larger when the surrounding air is dry.

At the heart of this system are stomata, tiny pores located mostly on the underside of leaves. Water vapor diffuses out of the leaf through the stomata (transpiration) and carbon dioxide (CO_2), a key ingredient for photosynthesis diffuses into the leaf. Each stoma is controlled by guard cells that open and close based on environmental signals. The number, size, and shape of stomata vary across soybean genotypes and growing environments. For instance, U.S. soybean varieties have been shown to have more stomata per unit leaf area compared to Japanese and other Asian varieties, which may partly explain differences in drought response and productivity.

Often, drought isn't just about dry soil, it's about a dry atmosphere. When the air has low humidity, it creates stronger atmospheric demand causing water to evaporate more rapidly from leaves. If the roots cannot supply water fast enough to match this loss, the plant begins to close its stomata to conserve moisture. But this self-defense mechanism comes at a cost: closing stomata restricts CO_2 intake, which in turn slows photosynthesis, the very process that fuels growth, seed development and yield.

Not all drought responses are biochemical. Some are morphological and immediate. If you've walked through a soybean field around noon or early afternoon, you may have noticed leaves standing upright, reflecting a silvery tone. This is para-heliotropism, a short-term drought response where leaves reorient vertically to reduce exposure to intense sunlight and heat. This response reduces radiation absorption during peak stress hours, helps avoid photodamage and overheating. It is often triggered by atmospheric dryness even when soil moisture is adequate to drive photosynthesis under normal conditions.

When soybean experiences drought stress during early vegetative stages, both stem elongation and leaf expansion are significantly reduced, resulting in smaller overall leaf area compared to well-watered conditions. However, if the drought is relieved early, through rainfall or irrigation, soybean plants can rapidly resume growth, often accelerating stem elongation and leaf expansion to compensate for earlier setbacks. This ability to recover explains why drought during vegetative stages is generally less or not damaging to yield compared to stress during reproductive stages. Nonetheless, when a dry spell coincides with reproductive stages (growth stages R1 toR5) soybean plants face a double burden:

- Photosynthesis drops due to closed stomata and perhaps smaller leaf area if stress occurred earlier during vegetative growth
- Biological nitrogen fixation also declines, because both processes are tightly linked.

As a result, developing seeds receive fewer carbohydrates and less nitrogen, leading to shriveled seeds, reduced seed weight, and yield loss (Figure 1, 2, 3).

Figure 1: Quality of soybean seed in two maturity groups planted side-by-side in the same field. The early maturity group experienced seed filling during the August drought of 2024, resulting in poorer seed quality, while the late group escaped the stress.

Figure 2: The same variety planted three weeks apart in the same field. Late-planted soybeans suffered less damage due to a shift in the timing of reproductive growth.

Figure 3: Seeds from drought-affected fields show widespread shriveling and poor fill.

Why This Matters: Managing for Drought Uncertainty

At first glance, the images might suggest that only late maturity groups or late planting can escape drought stress. While that may be true in this specific case, drought can occur at any stage and affect any maturity group. We cannot control drought stress in most of Kentucky's soybean fields, but we can deploy some management practices to reduce risk. Diversifying planting dates, and/or maturity groups is an option to mitigate against potential drought stress. This staggers the risk and increases the chance that at least part of the crop will avoid the worst of the stress. If you have access to irrigation, applying sufficient water at or after R3 growth stage (beginning pod development) will ensure competitive yield.

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Dr. Mohammad J. Shamim, UK Extension Associate Grain Crops

(859) 539-1251 mshamim11@uky.edu

Dr. Dennis Egli, UK Professor Emeritus

(859) 218-0753 degli@uly.edu

Time and Crop Productivity

Dr. Dennis B. Egli, UK Professor Emeritus

Time is an important resource. We never seem to have enough, and it often passes too fast. But the truth is, we don't often think about time when we think about crop productivity. We know that high yields require a fertile soil, a good variety, plenty of rain at the right time, and maybe a little luck, but time can also play an important role in determining crop productivity.

The length of the growing season (time from the last frost in the spring to the first frost in the fall) determines the time available for crop growth in temperate climates. It also determines the total amount of solar radiation (the energy source for crop growth) available for crop growth (ignoring winter crops, such as winter wheat).

The average length of the growing season and the total solar radiation during the growing season roughly doubled along a transect from far-northern Minnesota (49º N latitude) to New Orleans, Louisiana (30º N latitude). Doubling time and energy did not translate into an increase in average yields of soybean or irrigated corn. These crops could not use the extra time or the extra solar radiation to produce higher yields even when the total growth duration of varieties (hybrids) used increased as the growing season increased. Grain crops are just not very efficient in using time to produce yield.

The key to understanding this inefficiency lies in the length of the reproduce growth phase -flowering, seed set and seed filling – which doesn't increase in step with the total growth duration. Our summary of data from 13 grain crops (including corn and soybean) suggested that the length of the reproductive growth phase reached a maximum when the total growth cycle reached about 100 to 110 days and did not change as the total growth cycle continued to increase. The length of the seed-filling period is the same on a variety that matures in 110 or 140 days.

The length of the seed-filling period is directly related to yield. The longer the seed-filling period, the higher the yield. So, if the seed-filling period doesn't increase in step with the total growth duration, it is not surprising that yield doesn't increase. A Maturity Group I soybean variety produced the same yield as a Maturity Group V variety in 40 fewer days in irrigated field experiments at Lexington, KY. The early variety was grown in narrow rows to insure that the smaller vegetative plant provided complete ground cover, an important consideration when comparing varieties of different maturities.

The seed-filling period is usually only 30 to 40 days long, so all the grain yield is produced in a relatively short interval, another example of the inefficient use of time by grain crops. A Maturity Group III soybean variety, for example, grows for about 75 days before it finally gets around to producing seeds (yield). All systems must be in the go mode to produce high yields in such a short time.

The length of the seed-filling period is under genetic control in most crops. When plant breeders select for higher yield, the higher yields often come from longer seed-filling periods.

The length of the seed filling period increase as temperatures decrease. Lower temperatures mean longer seed-filling periods and higher yields. In fact, the late W.G. Duncan, a famous Crop Physiologist at the University of Kentucky, theorized that the ideal environment for high yield would have warm days (to maximize photosynthesis) and cool nights to lengthen the seed-filling period. Locations that meet these criteria have produced remarkedly high corn yields.

Water stress during seed filling will accelerate leaf senescence, shorten the seed-filling period, and reduce yield. We found in greenhouse experiments that just 3 days of water stress accelerated leaf senescence and the acceleration was not reversed when the plants were re-watered, suggesting that just a few days of water stress may be enough to shorten the seed-filling period and reduce yield.

There are two interesting implications of the way that grain crops use time to produce yield. First, using a late maturity variety (longer total growth duration) doesn't necessarily increase yield because the seed-filling period isn't longer. This raises the possibility of using early varieties without sacrificing yield, although it may be necessary to use narrow rows to insure complete ground cover by the beginning of reproductive growth. Early varieties may be useful in water scarce environments to reduce water use without reducing yield.

Secondly, double cropping may be the only way to capitalize on longer growing seasons (climate change is making them even longer). Double cropping (growing two crops in the same calendar year) results in two seed-filling periods in one year, circumventing the problem of the short seed-filling period.

Time is an unappreciated resource that affects cropping systems and crop productivity. Time often controls where crops can be grown (is there enough time for the crop to mature?) and it affects how crops use the available time to produce yield. Understanding how crops use time to produce yield leads to the development of cropping systems that are more efficient and more productive. But remember, "if you can't afford to waste time, you will never find the truth" Yuval Noah Harari (Israeli historian and writer).

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Dr. Dennis Egli, UK Professor Emeritus
(859) 218-0753 degli@uly.edu

Corn is Demanding a Lot of Water and Our Soils Should Have It

Dr. Chad Lee, University of Kentucky

According to the July 6, 2025 USDA Crop Progress Report, 40% of corn in Kentucky had reached silking and 4% had reached the dough stage. From the earliest appearance of tassels until pollination is complete corn demands the most water and is the most sensitive to a lack of water. The corn at dough stage is on the other side of the peak water demand. Corn will need adequate water all the way to black layer (R6 growth stage or physiological maturity) but its demand declines at about the blister stage (R2) or shortly after.

Some estimates place corn water use as high as 0.33 inches per acre per day from tassel until blister. Since the corn canopy fully shades the soil, this 0.33 inches per acre is transpired from the crop into the atmosphere. Water moving from the soil into the roots and through the plant helps it develop, grow and maintain plant functions. A lack of water disrupts nutrient uptake, temperature regulation and stops or slows growth.

For much of the corn in Kentucky these past few weeks, water use was likely at 0.33 inches per acre per day with air temperatures exceeding 86 degrees Fahrenheit most days since June 21st. For example, Christian County, KY has had ten days above 86 F since June 21. In Simpson County, every day but one has been above 86 F. In Hardin County, every day since June 21 has been above 86 F.

Most pollen drop occurs in the morning and most fields have had adequate water to this point. Based on these factors, pollination should have been successful in fields already pollinated. For corn currently pollinating, we should expect good seed set as well.

Corn in this region will require roughly 20 to 25 inches of water from planting to black layer and about 10 to 12 inches from silking to black layer. The typical Crider silt loam soil will hold about 6 to 8 inches of plant available water at field capacity. Indications are that most soils across the state are holding enough water to complete pollination and get corn through early seed development. These fields will need timely rains to complete seed fill, but all things considered, much of the corn crop is favorably positioned.

For the 60% of corn that was not at silking on July 6th, that ranges from V2 (two fully emerged leaves) to V14 (just a few days before tasseling and silking) across the state. The corn will grow rapidly through the vegetative stages. Younger corn will demand less water and that water demand will increase the closer it approaches tassel and silking. Corn in those fields should not be suffering from a lack of water for most of the state. Those fields with younger corn will need a few more timely rains than corn at silking to finish out the crop.

Any corn that is suffering from sidewall compaction and subsurface compaction is not in a good position. Roots restricted mostly to the seed furrow or roots restricted to shallow depth in the field will not be able to access as much water. These plants are at great risk for running out of water. In fact, right now rolling corn leaves are likely due to soil compaction.

If soil compaction is suspected, use a tile spade to dig out some corn plants. Pretend that you are trying to pot that corn plant into a 5-gallon bucket and dig an area large enough to fill that bucket. Once you have the corn plant out of the soil, you can either gently knock soil off the roots with the spade or use a garden hose to wash the soil away. Roots should be growing mostly in a half globe shape, and most of roots should be in the upper 8 inches or so with some roots extending beyond that. If all the roots look like a mohawk or clearly bend at 2 to 6 inches, then those plants are suffering from compaction. If corn roots are severely limited by compaction, there is no economically sound way to help those plants recover at this point. A gentle 1 inch of rain occurring over about a 4-hour period every 5 to 7 days is the only thing that can save those plants.

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Dr. Chad Lee, UK Grain Crops Specialist
Director- Grain & Forage Center of Excellence
(859) 257-3203 Chad.Lee@uky.edu

Postharvest Management of Canola and Wheat

Dr. Sam McNeill, UK Extension Agricultural Engineer

Canola and wheat are mostly harvested across Kentucky, so now is a good time to review some of the physical properties of these crops in order to maintain their quality during storage. An important consideration is how these grains interact with air to control biological activity that can potentially cause spoilage and a loss in value. This article focuses on the factors that determine the storability of these crops, namely grain moisture, temperature, and initial condition after harvest (amount of trash and broken grain); and the specific airflow requirements for drying and conditioning these small seeds. Keeping grain in good condition during storage prevents clumps from forming in a bin and the safety risks associated with entering one altogether.

Equilibrium moisture represents the point when there is no exchange of water vapor between seed and the surrounding air and establishes the grain-specific limits of drying and storage. This occurs after sufficient exposure time in the field or in bin dryers with little or no heat added. Tables 1 and 2 show the equilibrium properties for wheat and canola, respectively, for specific temperature and relative humidity conditions. Keep in mind that molds begin to grow when the relative humidity is above 65% (highlighted column in both tables) and that the average monthly temperature in Kentucky during July and August is about 80 degrees. Thus, the recommended storage moisture for soft red winter wheat is 12.5%. For canola at 40% oil content, the seed should be 8.2% moisture for safe storage. However, canola seeds with 50% oil should be stored at a lower moisture of 6.5% to preserve seed quality.

Table 1. Equilibrium moisture content of soft red winter wheat (%wb) at different temperature and relative humidity levels. Source: ASAE Data D245.6.

	Relative Humidity (%)								
Temp.	20	30	40	50	60	65	70	80	90
F	Equilibrium moisture content, %wb								
35	8.9	10.2	11.3	12.3	13.4	14.0	14.7	16.1	18.2
40	8.7	10.0	11.1	12.1	13.2	13.8	14.4	15.9	18.0
50	8.4	9.6	10.7	11.8	12.9	13.4	14.1	15.5	17.6
60	8.1	9.3	10.4	11.4	12.5	13.1	13.7	15.1	17.2
70	7.8	9.0	10.1	11.1	12.2	12.8	13.4	14.8	16.9
80	7.5	8.7	9.8	10.6	11.9	12.5	13.1	14.5	16.6
90	7.3	8.5	9.6	10.6	11.6	12.2	12.8	14.2	16.3

Table 2. Equilibrium moisture content of canola (%wb) with 40% oil content at different temperature and relative humidity levels. Source: ASAE Data D245.6.

	Relative Humidity (%)								
Temp.	20	30	40	50	60	65	70	80	90
F	Equilibrium moisture content, %wb								
30	4.5	5.9	7.4	8.8	10.3	11.2	12.1	14.2	17.2
40	4.1	5.5	6.8	8.1	9.6	10.4	11.2	13.2	16.0
50	3.8	5.1	6.3	7.6	9.0	9.8	10.5	12.3	15.0
60	3.6	4.8	6.0	7.1	8.4	9.2	10.0	11.6	14.2
70	3.4	4.5	5.6	6.8	8.0	8.4	9.3	11.0	13.5
80	3.2	4.3	5.3	6.4	7.6	8.2	8.9	10.5	12.8
90	3.0	4.1	5.0	6.1	7.2	7.9	8.6	10.0	12.2

All stored grain should be cooled to 60 degrees as soon as possible in late summer or early fall to control insect activity as well. Tables 1 and 2 also show that at this temperature, soft red winter wheat at 12.5% creates a relative humidity in the bin of about 60%, which adds further protection to hold mold growth in check. Similarly, canola seeds with an oil content of 40% and 8.2% moisture will create an RH of about 62%.

Drying time will depend on the weather conditions and airflow rate through grain, which in turn depends on the depth. The minimum airflow rate for natural air and low-temperature drying is 1 cubic feet per minute/bushel, which can require considerable fan power and severely limit the depth of small grains in most farm bins. The airflow rate in an existing bin can quickly be estimated by a decision tool from the University of Minnesota. By entering the bin diameter, wall height, desired airflow rate, grain and floor type, the number of bushels, static pressure and airflow rate per bushel are calculated in 2-4 feet intervals, depending on the eave height.

An example for canola and wheat in a 30 ft diameter bin with a 30 ft eave height and a typical 3 hp centrifugal fan that can deliver 2500 cfm at 5.0 inches of static pressure is shown in Table 3. Keep in mind that the program extrapolates values slightly beyond the fan data and the calculated resistance to airflow (static pressure, shown as inches of water) generated at a specific depth can exceed the capability of the fan. In this example, the selected fan will perform well for wheat but exceeds its limit for canola above 21 feet (as shown in the highlighted values). Note that other recommended airflow rates can also be evaluated by this program including 0.5 cfm/bu for cooling hot grain from a dryer and 0.1-0.2 cfm/bu for aeration. In this example, the minimum airflow rate for drying limits the depth to about 8 feet for canola and 9 feet for wheat. Also, when cooling hot grain from a dryer, the depth for canola and wheat should be limited to about 12 feet and 15 feet, respectively. Lastly, the rule of thumb for estimating the number of hours for aerating clean grain is easily calculated by dividing 15 by the airflow rate. So, 75 hours of total fan operation are needed when the bin is full (0.2 cfm/bu), whereas only 15 hours are needed at 1 cfm/bu.

More information on handling, drying and storing canola, wheat and other small grains is available in the references provided as well as your county extension office or by contacting the author.

Table 3. Airflow rates with a 3 hp centrifugal fan for canola and wheat in a 30-ft diameter bin filled to a depth of up to 30 feet. Source: Fan selection software from the University of Minnesota Department of Bioproducts and Bioengineering https://bbefans.cfans.umn.edu/

		Canola			Wheat		
Depth		S.P.	Airflow		S.P.	Airflow	
ft	Bushels	in. water	cfm	cfm/bu	in. water	cfm	cfm/bu
3	1,696	1.7	5,170	3.1	0.8	5,600	3.3
6	3,393	2.9	4,555	1.3	1.5	5,260	1.6
9	5,089	3.8	4,080	0.8	2.1	4,960	1.0
12	6,786	4.3	3,500	0.5	2.6	4,700	0.7
15	8,482	4.7	3,030	0.4	3.1	4,460	0.5
18	10,179	4.9	2,680	0.3	3.5	2,250	0.4
21	11,875	5.0	2,400	0.2	3.9	4,060	0.3
24	13,572	5.1	2,133	0.2	4.1	3,800	0.3
27	15,568	5.2	1,930	0.1	4.3	3,545	0.2
30	16,965	5.3	1,760	0.1	4.5	3,320	0.2

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Dr. Sam McNeill, UK Extension Agriculture Engineer

(859) 562-1326 sam.mcneill@uky.edu

2025 University of Kentucky
Small Grain Variety Trial Results

Bill Bruening, UK Research Scientist

The 2025 University of Kentucky Small Grain Variety Trial results are available at: https://varietytesting.ca.uky.edu/wheat . There were 70 entries evaluated in the 2024-25 growing season. Data includes variety performance results for wheat, barley, cereal rye, oats and triticale. Wheat results include grain yield information from 7 trials, as well as straw & forage yield information and cover-crop/winter biomass potential. Wheat disease ratings were taken for leaf rust, head scab, leaf blotch, wheat streak mosaic virus and powdery mildew. Wheat varieties were also rated for tolerance to Metribuzin herbicide.

In addition to the currently available results in Excel format, the Kentucky Small Grain Variety Performance bulletin will be published soon and will be available online and printed copies will be available at all county extension offices.

For additional information, contact Bill Bruening- bruening@uky.edu.

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Bill Bruening, UK Research Scientist III

(859) 218-0802 brueining@uky.edu

UK Corn, Soybean & Tobacco Field Day

July 22, 2025

Registration begins: 7:00 CT
8:00 am-12:00 pm CT

UKREC FARM,
300 EXTENSION FARM RD.,
PRINCETON, KY 42445

TOPICS include:

AGRONOMICS AND ECONOMICS

- Economic Update
- Round Bale Economic Discussions
- Weed Science Update 2025
- Corn Needs for Nitrogen and Sulfur Following Cover Crops
- Foliar Fertilizer Rarely Increase Yield in Soybean Across the U.S

IPM

- Corn Disease Concerns for 2025
- Familiar and New Soybean Diseases to Look Out for in 2025
- Emerging Mollusk Pests & Insect Threats in Field Crops in Kentucky

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SOILS

- NRCS Soil Health Updates
- Agr-1 Update: Corn N Rate Recommendations
- The Current Status of Sulfur Fertility for Row Crop Production

TOBACCO

- Red Leaf Burley Demonstration and UKREC Tobacco Research Update
- UT Tobacco Research Update
- Optimizing Plant Populations for Burley Tobacco
- Assessing Quadris Effectiveness in Target Spot Populations

Educational Credits:

CCA CEUs

GC IPM/Soils : Nutrient Mgmt (1.0), IPM (1.0)
GC Agronomics/Economics: Crop Mgmt. (1.5)
Tobacco: Crop Mgmt. (1.0), IPM (1.0)

Pesticide CEUs:

IPM/Soils: 1 CEU for Cat 1a, 1 CEU for Cat

Altria
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KYCORN

Kentucky Soybean Board

UPCOMING EVENTS

CORN, SOYBEAN & TOBACCO FIELD DAY	**July 22nd**
KY High School Crop Scouting Competition	July 24th

To sign up & receive the **Kentucky Field Crops News**, click the link: KFCN NEWSLETTER or scan the QR code.