Photo credit: CAFE, UK Agricultural Communications Services

Corn & Soybean News

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Fall Armyworms Affected Double-Crop Soybeans in Many Counties of Kentucky in 2021

The larval stage of the fall armyworm (FAW), *Spodoptera frugiperda* (Lepidoptera: Noctuidae) is a voracious defoliator of many plant species. The FAW is a native pest of the New World, in South America and North America. However, it overwinters in south Florida or in the southernmost region of Texas (The Rio Grande Valley) in the continental USA. The adults (Figure 1) are strong fliers and move northward during the summer months. In double-crop soybeans, fall armyworms can be devastating defoliators affecting plants from the seedling to V4 stages.

Figure 1. (Left) Female and male fall armyworms. Photos by University of Missouri and R. Villanueva; (Right) two male FAW with folded wings.

FAW started to appear in Kentucky at the end of June to beginning of July, but as they continue their migration pathway to northern areas, they can also have large populations during the fall. This migration covers most states east of the Rocky Mountains and includes several provinces of Canada (for example, Ontario, Quebec, Nova Scotia). Fall armyworms were found in Africa 5 years ago; now this insect is a well-established pest in different African countries and is causing severe damage in many crops.

Problem

During the last 2 weeks, there have been reports of FAW outbreaks affecting forages, sorghum, and soybeans (although corn is affected, I have not heard of any damage in this crop). This has been happening in several counties of Central and Western Kentucky from La Center to Bowling Green (Ballard and Warren Counties, respectively). Crop consultants and County Extension agents started to notice this event and warned growers in Lyon and Ballard counties.

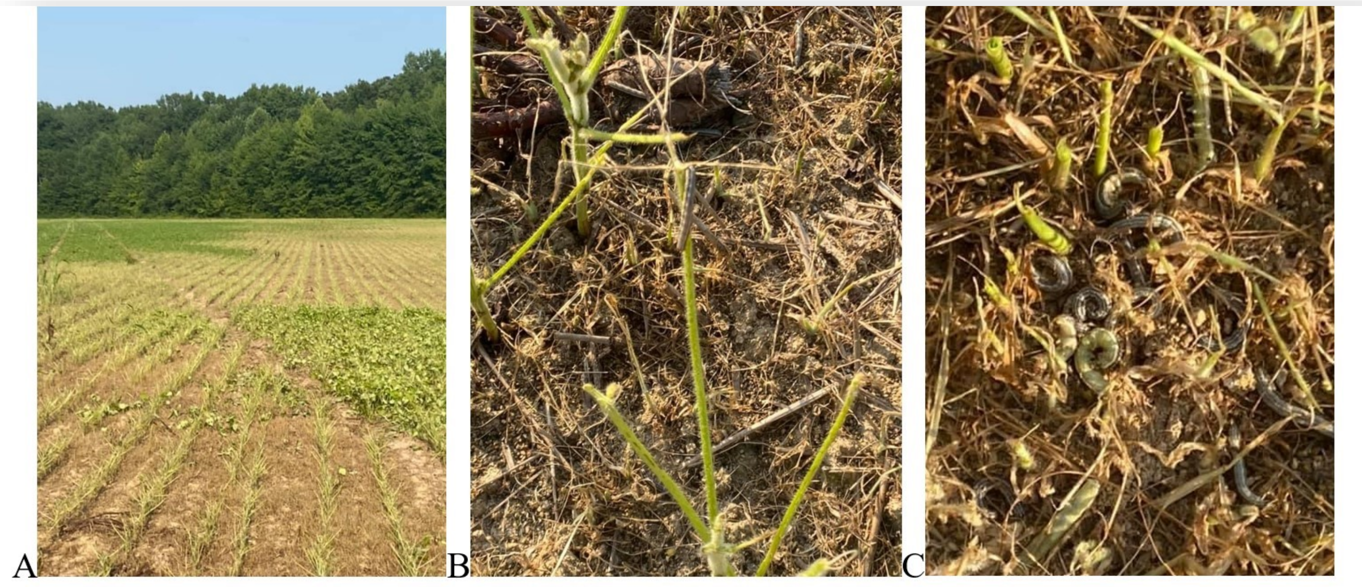

Figure 2. (A). Soybean field damaged by fall armyworms and (B) and (C) close-up of a soybean plant left without any leaves and a larger than 3/4-inch FAW on the tip of plant (Photos: Todd Elkins)

Small larvae skeletonize the lower leaves; large larvae feed over the whole plant. Severe damage caused by FAW in a commercial field of double-crop soybeans in Central Kentucky is shown in Figures 2A, 2B and 2C. In most cases, severely damaged plants can have a ragged appearance or be left without leaves (Figure 2B and 2C).

The pheromone-based trap in Princeton recorded 152, 280, 340 and now 23 FAW moths through the last 4 weeks (July 9 to August 6), indicating that moth flight may have peaked by the end of July, nonetheless they may have another peak. Also, egg masses were observed in some crops. Moths in Lexington traps have not been detected.

Biology

Female FAW (Figure 1) deposit egg masses of 50 to 200 eggs per cluster. Clusters are covered with scales (Figure 3). A single female can produce up to 2,000 eggs during its life span. Fall armyworm larvae emerge (Figure 4) and start to feed on plants causing unnoticed defoliation while they are small. However, as they molt to the next developmental stages (Figure 5), their appetite increases, and the defoliating damage is greatly noticed by farmers and scouting agents. The FAW has six larval instar that can be completed in 14 to 30 days, depending on the temperature. Fall armyworm resembles corn earworm and armyworm; however, fall armyworm has a white inverted "Y" mark on the front of the dark head (Figure 5). Pupation occurs in the ground and adults can live up to 20 days.

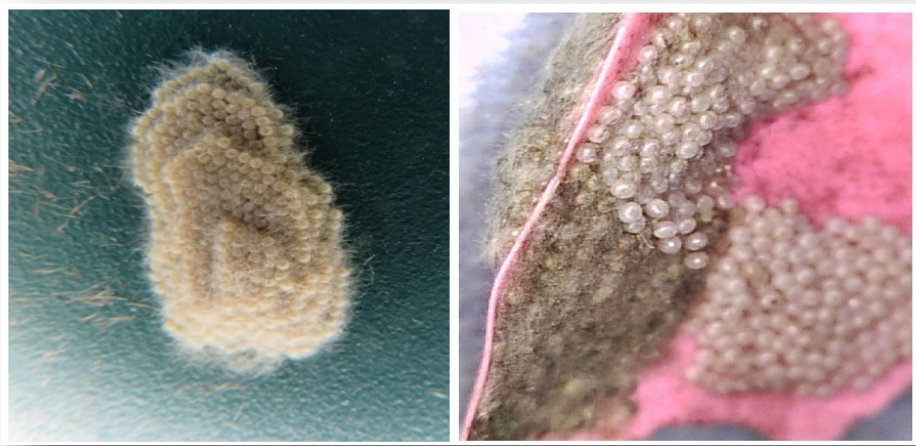

Figure 3. Egg clusters of fall armyworm collected on July 8 and July 30, 2021. Females lay between 50 to 200 eggs; these cluster on leaves, wood poles, screens, or plastic field flags. Scales cover egg clusters as seen in pictures (Photos by C. Whitney and R. Villanueva)

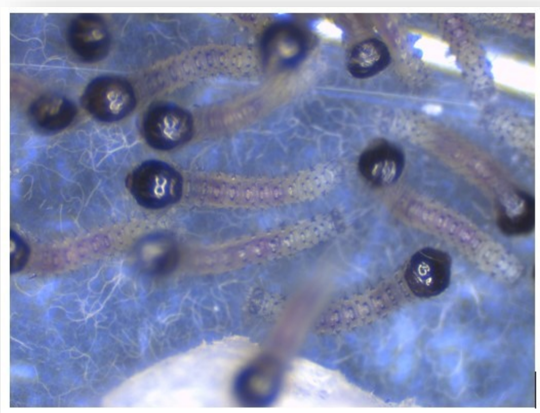

Figure 4. Recently emerged fall armyworm larvae; notice the black head capsule (Photo: Raul Villanueva, UK)

Figure 5. A distinctive, light-colored inverted "Y" mark is present on the head capsule of fall armyworms. Also, pay attention to coloration changes of FAW larvae (Photo: Raul Villanueva, UK)

Management

The late vegetative stage of soybeans can support heavy feeding and can tolerate nearly 100% foliage loss during the early vegetative stages before yield loss is achieved. However, if double-crop soybeans are affected in the early seedling stage, the results may be devastating.

Alarming reports have been broadcast in local news about the widespread damage caused by FAW and the lower efficacy of pyrethroids in some fields. This was explained as an increase in resistance by FAW; however, if insecticides were utilized when larvae were larger than ¾ inch, the level of control maybe diminished compared with a greater efficacy against larvae that are smaller.

Insecticides, such as pyrethroids, are effective against this pest, but it is known that their efficacy decreases for late larval instars. Early detection of infestations will allow for more effective control of this pest if larvae are larger than ¾ inch in length. In corn, the larvae can form a frass plug in the whorl, and this reduces the ability of insecticides to contact the larvae. A dual mode of action insecticide with systemic capabilities, may be used.

In soybeans Leverage® 360 (*imidacloprid + cyfluthrin*) at 2.8 fl. oz/A is effective for the 1st and 2nd larval stages; however, Leverage® 360 is not registered for corn in KY. Also, for late stages of FAW larvae (greater than 3/4 inch), probably a dual mode of action insecticide, such as Besiege® (*chlorantraniliprole + lambda-cyhalothrin*) at 8-10 fl. oz/A, Hero® (*zeta-cypermethrin + bifenthrin*) at 4-10.3 fl. oz/A; Elevest® (*bifenthrin + chlorantraniliprole*) at 5.9-9.6 fl. oz/A) may be more effective than single mode of action products.

For all these insecticides, the use of high volumes of water will generally result in better coverage, especially under adverse conditions (e.g., hot, dry) or where a dense plant canopy exists, especially if the FAW migration continues. These types of migratory waves are of short duration and rarely will be duplicated; however, FAW can be present until the fall.

Insect Thresholds

In **soybeans,** a threshold for FAW is not well established, but you can use the following: control is required if egg masses are present on 5% of the plants, or 25% of plants are infested with larvae.

Although damage has not been observed in **corn**, insecticide treatments must be applied before larvae burrow deep into the whorls or enter ears of more mature plants. If sweeping with a 15-inch sweep net, an average of 9 larvae per 25 sweeps would indicate a need for control.

The thresholds used in North Carolina for defoliating insects is 30% defoliation throughout the plant canopy 2 weeks prior to blooming (R1) and 15% defoliation throughout the plant canopy 2 weeks prior to flowering (stage varies) until the pods have filled (R7-R8).

More information:

Fall Armyworm Moth Numbers Increasing (KPN 07/27/21)

Armyworm Complex in Soybean (NCSU 04/07/2020)

Fall Armyworm in Corn (KPN 2019)

Watch for Fall Armyworm in Pastures (KPN 08/27/2019)

Fall armyworm in Featured Creatures (University of Florida) (Last updated 2019)

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Poultry Litter + Cover Crops = An Alternative When Fall Fertilizer Prices Are High?

A good fall soil fertility program is getting pretty pricey this year. As we write this, the latest DTN retail price survey (https://www.dtnpf.com/agriculture/web/ag/crops/article/2021/08/04/retail-potash-price-100-per-ton-2) has potash (0-0-60) at $549/ton, DAP (18-46-0) at $695/ton and urea (46-0-0) at $554/ton. These prices are about the highest we've seen in 10 years or so. People are starting to ask the question: Are there alternatives? The answer: Maybe. In Kentucky, poultry litter is plentiful and can serve as a major source of nutrients for our crop acres. And cover crops can help protect fall applied nutrients from winter-spring losses.

To evaluate poultry litter value, you need to have the field(s) soil tested to generate fertilizer nutrient rate recommendations. Litter is best viewed as a multi-nutrient source that can maintain overall soil fertility – less valuable when used as the sole source of a single nutrient – but also less valuable when field soil fertility is already high. You also need a litter analysis for nutrient and moisture concentrations. Then you can apply some economics. Drs. Jordan Shockley and Edwin Ritchey, as part of projects funded by the Kentucky Soybean Association (https://soybeanresearchinfo.com/research-highlight/all-poultry-litter-is-not-created-equal/), looked at the nutrient analysis results for over 700 samples (Table 1). Using the latest fertilizer prices (and correcting DAP for its N value using the urea price), litter's average fertilizer-equivalent value as an N-P_2O_5-K_2O source was $82/ton. And this does not include litter's value as a liming agent (the basic Ca and Mg compounds in the average ton of litter cause a CCE of 11.5%), as a source of micronutrients like Zn and Cu, and a nutrient rich organic carbon amendment that stimulates soil microbial activity and promotes soil health.

These calculations can be completed by hand or with the assistance of several online or downloadable calculators. The UK Division of Regulatory Services has several calculators that can be used to determine poultry litter rates (http://www.rs.uky.edu/soil/cal.php). Economic consequences of applying poultry litter can be evaluated with an Excel based calculator for row crops (**Economic Value of Poultry Litter Tool: Grain Crops**) and forages (https://agecon.ca.uky.edu/files/extpltoolpasture25.xlsx).

Table 1. Poultry litter nutrient concentrations (lb/ton on and as received/as is basis) for 706 samples submitted to UK's Regulatory Services between 2007 and 2012.

	N	P_2O_5	K_2O	Value*	Calcium	Magnesium	Zinc	Copper
	------- lb/ton, as is -------			$/ton	--------------- lb/ton, as is --------------			
Average	50	57	48	82	74	11	0.73	0.41
Minimum	12	4	2	10	0	1	0.10	0.02
Maximum	186	124	109	226	301	24	2.10	1.40

* Value ($/ton, as is) determined using only N ($0.60/lb), P_2O_5 ($0.52/lb), and K_2O ($0.46/lb).

To get the most value from the litter, start with litter analysis (including moisture content) and then do a good job uniformly spreading the litter (Figure 1). Calibrate the spreader, monitoring both the spread rate, the spread width, and the uniformity of litter distribution across that width. Different densities (due to moisture differences) result in different spread widths/distributions.

Figure 1. Spreader calibration for a poultry litter field application.

Fall applied poultry litter can lose N to ammonia volatilization, denitrification, and nitrate leaching. All litter nutrients (in addition to those in the nutrient-rich topsoil) are subject to erosion and runoff losses. Erosion and runoff rob nutrients from the field. Erosion carries nutrient rich lighter particles, litter and crop residue particles being among the lightest, to field areas that probably don't need them or off the field entirely.

Winter cover crops provide erosion control and enhance water infiltration. As they grow, winter cover crops take up soil nutrients (including nutrients released from decomposing poultry litter), immobilize them in their tissues and further conserving them against losses. Cover crops may consist of both legumes (clovers, vetches, winter pea) and non-legumes (winter cereals/brassicas), but non-legumes should dominate to better conserve the N released from decomposing litter, crop residues and mineralized from soil organic matter. Seeding a cover crop adds value to all fall applied nutrients, and especially to poultry litter (erosion losses of litter are more likely), but at the cost of the cover crop seed and the act of seeding.

Fertilizer has become increasingly expensive. Poultry litter may be an economically viable alternative to fertilizer, though its value is strongly related to litter nutrient concentrations and soil nutrient levels. Litter may be fall applied, especially in the presence of actively growing winter cover crops. If you have questions or comments, please contact John Grove (jgrove@uky.edu) or Edwin Ritchey (edwin.ritchey@uky.edu).

Rasnake, M. 1996. Broiler litter production in Kentucky and potential use as a nutrient source. AGR 168. Univ. Kentucky Coop. Extn. Svc. http://www2.ca.uky.edu/agcomm/pubs/agr/agr168/agr168.pdf

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Effects of Various Rates of Potash and Molluscicides in the Management of Slugs

Slugs, a pest once found in homeowner's gardens and greenhouses, have quickly become a problem in crop fields. Slugs belong to the gastropod family, which includes slugs and snails. Slugs have a unique biology because they have both male and female reproductive parts, making them a hermaphrodite. If slugs do not find a mate, they are capable of self-fertilization so that eggs are guaranteed to be laid. Slugs usually lay eggs in batches of around 10-50 eggs (Figure 1).

Figure 1. Pearl-shaped eggs of slugs oviposited in the laboratory. Ruler measures are in cm. (Photo by R. Davila)

Problem

Slugs can cause significant damage to field crops in their early stages. Slug outbreaks and feeding can reduce plant population densities and damage plants beyond the point of recovery. In soybeans, slugs usually feed on plants in the VE and VC development stages. If this occurs and the apical meristems are injured, the plant cannot recover (Figure 2). Slugs prefer weather that is cool, moist and, cloudy; under these conditions they will be active and feed all day. Otherwise, you are most likely to find them feeding from dusk to the early morning hours. It is important for farmers to know when to scout for slugs in their crops so they can take preventative actions to avoid a slug outbreak that would cause them to have to replant. In the spring of 2021, it was reported that there were soybean farmers that had to replant at least 4 times due to slugs feeding on seedlings in Central and Western Kentucky.

Figure 2. Damage caused by slugs on apical meristem and cotyledons. (Photo by Josey Tolley)

Management

There are many different approaches to controlling slug outbreaks. There is not a one-size-fits-all solution and treatment plans can vary from farmer to farmer. There are biological, chemical, and physical methods to control or reduce population of slugs.

- **Natural enemies**: Nematodes are being used to control mollusks in Europe. However, this approach has not been used in the United States yet. Carabid beetles also are known to be predacious of slugs. Josey Tolley (unpublished coauthor of this report), has been evaluating carabid species (ground beetles) feeding on slugs at the Research and Education Center at Princeton, KY during this season on field and laboratory studies.
- **Molluscicides:** A typical method for controlling slugs in vegetables or produce of high value is through applying molluscicides. They suppress the slug population by drawing slugs to the area of application and then killing them after the molluscicide has been ingested. Since slugs are becoming more of a problem in field crops, some farmers have started using molluscicides in their fields. In Hardin County, a farmer has applied molluscicides to his soybean field at costs averaging $20/acre to avoid replanting due to damage from slugs. In his case this farmer said that this is a feasible practice.
- **Fertilizers:** It is commonly believed that potash is effective in repelling or reducing slugs. Some farmers use this approach, but there is not much evidence that supports this claim. Potash is an alkaline potassium compound, or a salt. It is believed that it could burn or suffocate slugs. Below we are going to describe studies conducted about this topic.

Results of Studies Using Potash and Molluscicides

In this article, we are providing preliminary results regarding the use of potash to reduce slugs. The research for this project was conducted in the spring and summer of 2021 at the Research and Education Center in Princeton, KY. Both field and laboratory studies are included in this report.

In the field study, potash was applied at 2 rates of 100 and 200 lbs/A and plots were replicated 5 times. Tallies of slugs were conducted in these plots after application of potash in 4-ft row lengths and compared with an untreated plot. Six days after the application of potash, the number of slugs found in the 200 lbs/A plot were reduced to less than 1 slug and remained at that level for the rest of the study. In the control and 100 lbs/A plot, the number of slugs were above 1 during most dates of the study. (Figure 3) The greater number of slugs in the control and 100 lbs/A plot could be a result of the 200 lbs/A plot of potash effectively repelling the slugs to an area where a lesser or no rate of potash was applied.

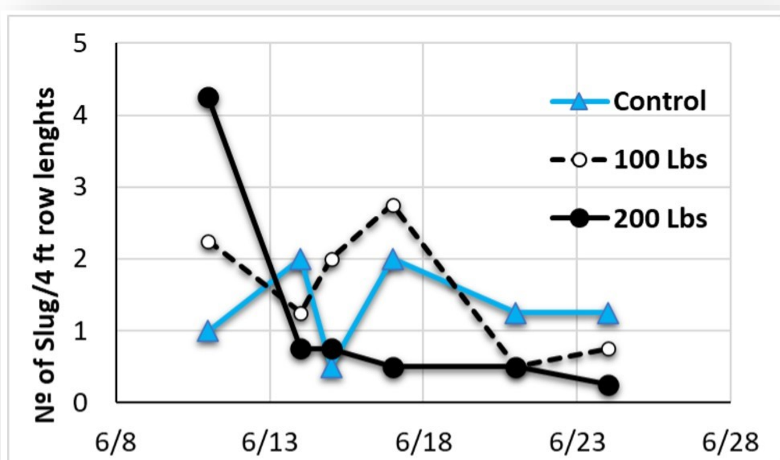

Figure 3. Number of slugs in 4ft-row lengths of soybeans where potash was applied on 06/08/2021.

In the laboratory, we studied the mortality of slugs caused by different rates of potash representing 50, 200, and 300 lbs of potash/A as well as 2 molluscicides (metaldehyde and iron phosphate (Sluggo®)) using plastic containers filled with soil. Potash and molluscicides were sprinkled on the soil. In each container we released a known number of slugs to evaluate slug mortalities and oviposition. In this study, we found that the molluscicide treatment (10 lb/A of metaldehyde) had the greatest percentage of slug mortalities (60%) followed by the recommended rate of iron phosphate (44 lbs/A) (55%), and the 200 lbs/A potash treatment caused 47% mortality (Figure 4). Interestingly, other rates of potash were used, and the mortality effects varied. For example, in the 300 lbs/A potash application there was a mortality rate of only 31% (Figure 4). In addition, in this study we found that the number of eggs oviposited was not affected by any of the potash rates, whereas molluscicides affected oviposition by reducing the number of eggs or totally blocking reproduction.

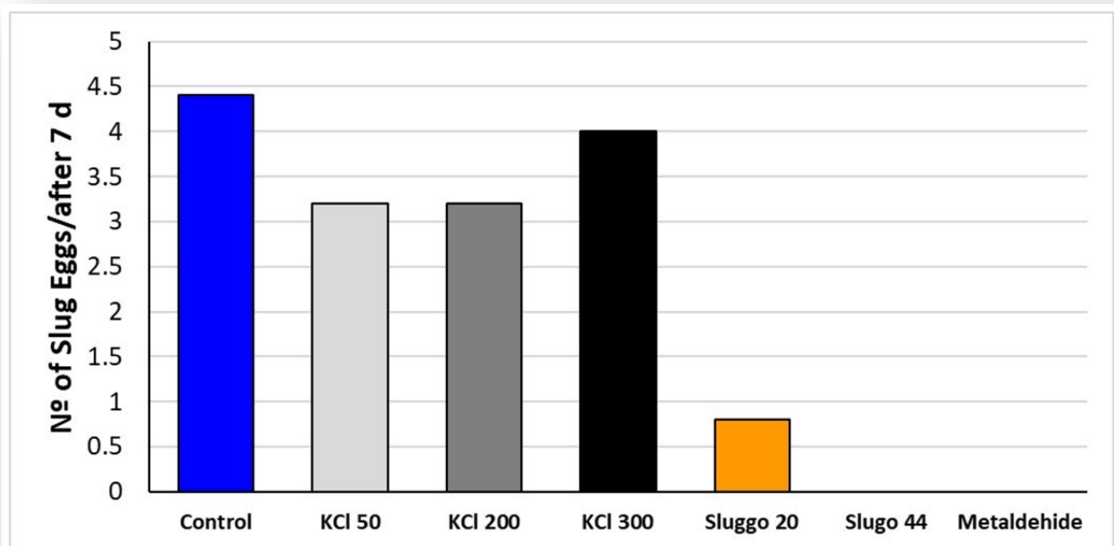

Figure 4. Number of eggs oviposited by slugs placed in containers that have three rates of potash (50, 200 and 300 Lbs/A), two rates of Sluggo (20 and 44 Lbs/A), metaldehyde (10 Lbs/A), and an untreated control in a study conducted in the laboratory.

Conclusion

Potash has some effect in repelling slugs, but the exact efficiency of its application or the recommended rate to use is still undetermined. Based on this project, the 200 lbs/A application of potash seemed to be useful in repelling slugs in the field study and it did a fair job of killing slugs in the laboratory study. However, when comparing molluscicides to potash, molluscicides had a higher rate of mortality in the laboratory study.

Acknowledgment

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By Josey Tolley, Student Intern in Entomology (Murray State University), Raul T. Villanueva, Entomology Extension Specialist, and Edwin Ritchey, Soil Extension Specialist at the Research and Education Center, Princeton, KY.

Corn and Soybean Yield Contest Rules Available

The Kentucky corn and soybean contests rules are available online.

- The 2021 Kentucky Corn Contest Rules are available at: https://graincrops.ca.uky.edu/.../2021kycorncontestrules.pdf
- The 2021 Kentucky Soybean Contest Rules are available at: https://graincrops.ca.uky.edu/files/2021soybeanproductioncontestrules.pdf
- Both can be found at: https://graincrops.ca.uky.edu/content/kentucky-yield-contests

Both of these contests are administered by the University of Kentucky Cooperative Extension Service and are heavily supported and promoted by the Kentucky Corn Growers Association, the Kentucky Soybean Association with support from the Kentucky Soybean Promotion Board and participating Agribusinesses. Winners will receive awards at the Kentucky Commodity Conference scheduled for January 13th, 2022 in Bowling Green, KY.

The Kentucky Soybean Contest forms are due November 15, 2022. The Kentucky Corn Contest forms are due two weeks after harvested or by November 30, 2022, whichever comes first.

For questions about these contests, contact your county extension agent.

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