

Corn & Soybean News

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Grain and Forage
Center of Excellence

Slugs and Snails Affecting Pre- and Post-Emergent Soybeans

Abundance of Slugs and Snails in 2014

The warmer winter season in 2024, rains and foggy conditions during several days in March and April, have been conducive for the presence of slugs and snails in commercial and research plots in Western Kentucky. Since the end of March and the first week of April we have been observing slugs in various stages of development as well eggs in soybean and corn fields. The favorable conditions described above might have increased their populations in field leading to a reduction of plant stands in several soybean fields, and in many cases entire fields were consumed. In fields heavily affected by slugs, plant stands per 5-ft row reached from 2 to 10 while these numbers under normal conditions should be between 20 to 30 plants per 5-ft row (average planting in KY: 5 to 6 seeds per ft-row in soybeans planted in 20" row width) (Figure 1). Snails were also observed in abundant number in



Figure 1. Images of 5-ft row in two soybean fields showing the reduction of plant stands caused by slug feeding: 4 plants (left picture) and 10 plants (right picture) (yellow arrows) in the center rows. Under normal conditions there should be 20 to 30 plants per 5-ft row lengths.

fields that have irrigation and abundant organic matter (Figure 2). Feeding behavior captured in fields showed that slug were feeding in insecticide and fungicide treated unsprouted seeds, and emerging seedlings (Figure 3). Either insecticides or fungicides do not affect slugs or snails. Also, observations since the first week of April have shown that eggs were laid in moist soils covered by



Figure 2. Soybean seedlings and dead slugs collected per 5-foot rows. Notice the different sizes of dead snails collected after the application of the metaldehyde baits.



Figure 3. (Left) Slug feeding on pesticide coated, swollen, and unsprouted soybean seed. (Right) Feeding damage on emerged and unsprouted seed.

organic matter from previous crop (soybeans, corn, or wheat). Figure 4 shows that slugs and snails were well protected under the dry brace roots of corn and ovipositing eggs under these structures.

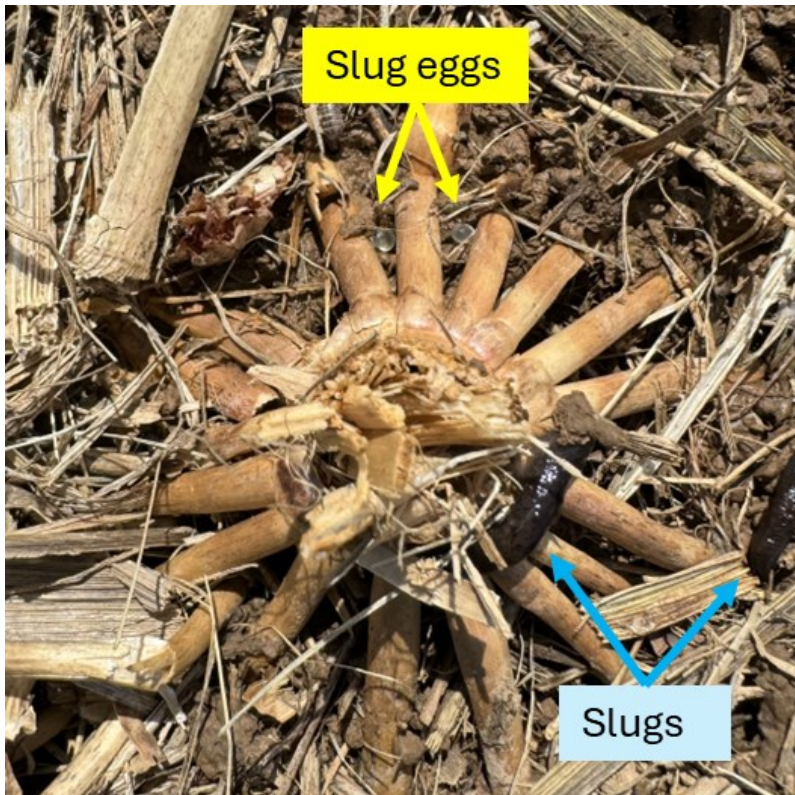


Figure 4. Corn stalk left in the field with the brace roots that sheltered snails and their eggs. Although, 2 eggs are shown in this image more than 15 snail eggs were found under the brace roots (Photo by R. T. Villanueva)

Mollusk Management

There is no rescue treatment for slug damage or thresholds for application of molluscicides. If stands are low replanting is recommended and an application of molluscicides may be necessary. In February 27, 2024, we wrote an article titled "[Slugs are Active in February 2024, but Farmers Have Two Registered Molluscicides under Section 24\(c\) in Kentucky](#)". In this article we wrote about the possibility of the abundance of mollusks during the germination period of corn or soybeans based on the environmental conditions and on two metaldehyde molluscicides that are registered under the Section 24(c) for soybeans and corn in Kentucky: Deadline® M-Ps™ and Slug-Fest®. In addition to these two products, Table 1 shows additional molluscicides that can be used in corn and soybeans for management of slugs or snails. Heavy rains after application of metaldehyde can potentially reduce its efficacy and carried out by the water runoff. Please read the molluscicide labels for the correct use of these products.

Table 1. Molluscicides* that are available in Kentucky for the management of slugs and snail in corn and soybeans.

Products	Crop	Growth Stage	Max. single Application	Total N ^o of Application /Season	RAI days	PHI days	Type of application
Deadline[®] M-Ps[™] <i>metaldehyde</i>	Field Corn	Up to V8	25 lbs/Acre	3	7	0	Broadcast or ground directed
		V8 to VT					
	Soybean	Up to V4	10 lbs/Acre				
		V4 to R1					
Slug Fest[®] <i>metaldehyde</i>	Field Corn	Seedling or later stages	59 fl.oz./Acre	3	4	0	Spray, may be tank mixed with other chemicals or fertilizers.
	Soybean	Seedling or later stages	23 fl.oz./Acre	4	3		
SLUGGO <i>Iron phosphate</i> 1%	Field Corn	Seedling or later stages	20 to 44 lbs/Acre	n/a	14	n/a	Broadcast or ground directed
	Soybean						
Bio-Sul <i>Sulfur</i> 1%	Corn Soybeans Small grains	Seedling	20 to 44 lbs/Acre	-	-	0	Broadcast or ground application
FERROXX <i>Sodium ferric</i> 5%	Corn Soybeans Wheat Rye	Seedling	5 to 20 lbs/Acre	-	-	0	Broadcast or aerial application

*The University of Kentucky does not endorse any of the products listed here, they are shown here for information purposes only.

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From Corn Emergence to Three Leaves

Corn from emergence to about the V3 growth stage (three fully emerged leaves) undergoes some dynamic changes in the plant and is highly susceptible to many of the insects, mollusks and fungi that like to eat corn.

Corn needs about 100 GDD's to emerge from the soil (VE growth stage). Roots directly from the seeds (seminal roots) anchor the seedling. The emerged plant conducts photosynthesis and starts to create sugars. However, from planting to about the V3 growth stage (three fully developed leaves) the young plant relies on mostly seed reserves for growth and development and very little from the seminal roots.

Corn reaches V3 growth stage (three fully emerged leaves) when about 275 GDD's have accumulated. At V3 the nodal root system is active, and the seminal root system starts to shut down. The growing point is below the soil surface and mostly protected from freezing temperatures.

At V3, the corn plant is shifting its nutrient dependence to the nodal root system and the three fully emerged leaves are allowing the plant to increase its photosynthetic capacity. During this shift, having some nutrients close to the nodal root system can help with his transition. The corn plant has taken up very little nutrients at this point. Usually from VE to V3, the corn plants will have more yellow color, even though adequate nutrients are available. Between the V3 and the V6 growth stages, the plant takes on a darker green color and begins to look "healthier".

Generally, the longer corn takes from planting to emergence the more susceptible corn is to insects and diseases. Delays in overall emergence also usually result in more uneven emergence. For example, if the average high and low temperatures were 65 and 50 degrees Fahrenheit, then corn would emerge in a little over 13 days. If the average temperatures were warmer at 75 and 60 degrees, then corn would emerge in a little less than 6 days.

Corn from VE to V2 growth stages is susceptible to slugs. Corn at V3 is large enough to usually re-



VE Corn



V2 Corn. Even though this corn had a starter applied, the small plants still have a slightly yellow appearance.

cover from slug feeding. Generally, the longer corn takes to grow from V1 to V3, the more at risk it is to insects and slugs. Cool, cloudy conditions slow corn growth and encourage more slug activity. If average high and low temperatures are 70 and 55 degrees Fahrenheit, corn will take about 14 days to grow from VE to V3. If temperatures are warmer and average 85 and 70 degrees, corn will reach V3 in about 6 and a half days.

Faster emergence and faster development from VE to V3 do not guarantee higher yields, but they do reduce risks of pests becoming a problem. The rainy and cloudy weather this year means that most of the crop is at higher risk to insects and slugs from VE to V3.

References:

Abendroth, L.J., R.W Elmore, M.J. Boyer, and S.K. Marlay. 2011. Corn Growth and Development. Iowa State Univ. Extension Publication #PMR-1009. <https://store.extension.iastate.edu/Product/Corn-Growth-and-Development>

Lee, C. and C. Knott, eds. 2022. A Comprehensive Guide to Corn Management in Kentucky. ID-139. Univ. of Kentucky Coop. Extension Services. Lexington. <https://www2.ca.uky.edu/agcomm/pubs/id/id139/id139.pdf>

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The Timing of Water Stress and Soybean Yield

When will it rain? How much will it rain? These questions keep soybean growers constantly checking the Weather Channel during the summer. In Kentucky, the average rainfall during the summer months is less than the average maximum potential water use by the crop. The higher temperatures associated with climate change will increase the potential use, but the mismatch will depend upon what happens to rainfall. Throw in soils that have limited water holding capacity and the amount and distribution of rainfall becomes a critical component of maximum yield production.

Water stress reduces yield, but all stresses are not equal. The effect of stress depends upon when it occurs. Some growth stages are more susceptible than others.

The life cycle of a soybean plant can be divided into three phases. First comes vegetative growth (Phase I) then flowering and seed set (Phase II) and finally seed filling (Phase III). All grain crops fit into this scheme, although there is some variation in details among crops. Soybean, for example, continues Phase I until the end of Phase II. Other crops, corn for example, have a clearer separation between Phases. Phase I in soybean starts at seedling emergence and continues until growth stage R5. Growth stage R1 marks the beginning of Phase II and growth stage R5 its end. Phase III begins at R5 and ends at growth stage R7.

This scheme is especially useful because it relates directly to the determination of the two yield components (seeds per unit area and weight per seed) that combine to make up yield [i.e., $\text{Yield} = (\text{seeds/unit area}) \times (\text{weight/seed})$]. Seed number is determined during Phase II while environmental variation in weight per seed is determined during Phase III.

Most of the environmental effects on yield are expressed by variation in seed number simply because it is determined first. Phase II is the first chance the crop has to adjust its reproductive output to environmental conditions. Weight per seed responds to the environment during phase III.

Thinking about when water stress occurs during these three phases helps us understand its effect on yield.

Vegetative growth (phase I) is probably least sensitive to water stress. Water stress during this phase will reduce growth. This reduction, however, will probably not carry over to affect yield if it starts raining during Phase II, assuming that there is enough leaf area to provide complete ground cover by the beginning of phase II. If the stress is severe enough to prevent complete ground cover, yield will be reduced even if it rains during phase II and III. The size of the vegetative plant is usually not closely associated with yield,

Stress during phase II will probably reduce yield because it will reduce the number of seeds the crop produces. Seed number is related to canopy photosynthesis and the availability of sugars during Phase II, so any reduction in photosynthesis as a result of stress will reduce seed number and proba-

bly yield. Increases in weight per seed can compensate for small reductions in seed number (assuming it starts raining again during Phase III). There is a limit though to how much weight per seed can increase and how much compensation can occur.

Stress during Phase III will reduce weight per seed and yield. Water stress during Phase III accelerates leaf senescence (the destruction of the photosynthetic apparatus in the leaf that occurs normally during seed filling), and shortens the seed-filling period, reducing weight per seed and yield.

Stress during seed filling may not be as obvious as earlier stresses, so it can be a 'hidden' stress. The stressed leaves go through their normal senescence pattern (turn yellow and fall off the plant), they just do it faster. If well-watered plants are not available for comparison, the yield reduction may not be noticed until harvest. The early maturation of soybean plants on hilltops provides a classic example of stress during seed filling. The plants on the hilltops were growing in shallower soils, so they experienced stress and matured before the plants in lower areas that had access to more soil water.

We found in greenhouse experiments that the acceleration of senescence by water stress could not be reversed by adding water to relieve the stress. We stressed soybean plants for three days early in the seed-filling period (Phase III) and then watered them to relieve the stress, but the accelerated senescence continued, and yield was reduced by nearly 20% due entirely to smaller seeds.

'Hidden' stress can be an important source of lower yields, since short periods of water stress can occur in the absence of wide-spread significant drought. The sensitivity of senescence to short-term water stress suggests that high yields may require a complete absence of water stress during seed filling.

When water stress occurs, the big question is – will it reduce yield? It all depends upon how much stress and when it occurs. Soybean can take some stress during vegetative growth without affecting yield. Phases II and III are the critical periods - stress during these periods will probably reduce seed number and/or weight per seed which will result in lower yields. The old Spanish proverb that says, "civilization and anarchy are separated by seven meals" (quoted by J. Cribb in "The Coming Famine") illustrates perfectly the dangers of a lack of water.

Adapted from Egli, D.B. 2021. Applied Crop Physiology. Understanding the Fundamentals of Grain Crop Production. CABI. 178 pp.

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Conditions favorable for seedling disease in corn

Seedling diseases are caused by several soil or seed-inhabiting fungi or fungal-like organisms which are favored by cool, wet soil conditions during and after planting. Cool, wet soils also slow plant growth and development and give pathogens more time to infect and damage the seedling. Standard corn fungicide seed treatments provide a short window of protection against seedling diseases. However, corn that was planted several (or more) weeks ago may also be at increased risk of seedling disease, since seed treatments typically protect seeds and seedlings only for a few weeks. Two of the most common seedling diseases of corn in Kentucky are caused by *Pythium* and *Fusarium* species, but other fungi can occasionally cause seed and seedling issues.

Symptoms of seedling diseases can be observed after emergence and in the early vegetative stages of growth. Farmers should look for areas in the field with poor emergence, patchy stands, and/or stunted plants (Figure 1). Often these symptoms are observed first in poorly drained or ponded areas of



Figure 1. Corn plants affected by seedling disease may have poor emergence within a row or an area in the field. Photo by Kiersten Wise, University of Kentucky

the field, and areas with heavy or compacted soils. Infected seeds may rot after germination, preventing emergence and leading to the patchy appearance of plants in a field. Infected plants that do emerge may be yellow, stunted, and have discolored roots. In severe cases, large areas of plants may die leading to reduced stand (Figure 2). It is very difficult to accurately determine the specific organ-

ism responsible for a suspected seedling disease issue in the field. Submitting samples through a County Agent to the University of Kentucky Plant Disease Diagnostic Laboratory can help with obtaining an accurate diagnosis.

The risk of corn seedling disease decreases when corn is planted into dry soils with soil temperatures above 50 F. These conditions allow seeds and seedlings to germinate and emerge rapidly. However, it is often necessary to plant into less than ideal soil conditions, and diagnosing seedling disease issues if they occur can improve management in future years. Obtaining an accurate diagnosis is important because fungicide active ingredients work against specific organisms, and efficacy of a given product can vary for seedling blight organisms. Higher rates of specific products may be needed in fields that have a history of severe loss due to a specific seedling disease.



Figure 2. Severe stand reduction due to seedling disease. Photo by Kiersten Wise, University of Kentucky

More information on corn seedling blights can be found in the University of Kentucky Extension Publication, "Seedling Diseases of Corn." <https://plantpathology.ca.uky.edu/files/ppfs-ag-c-02.pdf>

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Ryegrass Escapes in No-Till Corn

Postemergence herbicide applications on corn have already begun and will continue for the next couple of weeks as weather permits. It appears that ryegrass continues to be problematic for many no-till corn growers with more complaints of burndown failures occurring this year. Many applicators will have to deal with the dilemma of how to control escaped ryegrass in no-till corn with their postemergence herbicide applications.

Italian ryegrass (aka annual ryegrass) can be very competitive with emerging corn, especially at high densities. Although ryegrass matures and dies by mid-June, the established plants can provide enough competition early in the season to impact corn yields. There have been scenarios in the past couple years in which a corn replant has been warranted due to excessive ryegrass escapes. Unfortunately, the options for controlling ryegrass after corn emergence can be very limited due to the size of the ryegrass and herbicide resistance.

Once corn has emerged there are only a few products that can be applied postemergence in corn that can provide control or suppression of ryegrass. Products that contain the active ingredients of glyphosate, nicosulfuron, or glufosinate can provide the most suppression or control of ryegrass. Rimsulfuron, tembotrione, topramezone, and mesotrione provide some suppression of ryegrass, although overall control would be considered poor. Our ratings for ryegrass control are listed in Table 1 with products organized by active ingredient groups.

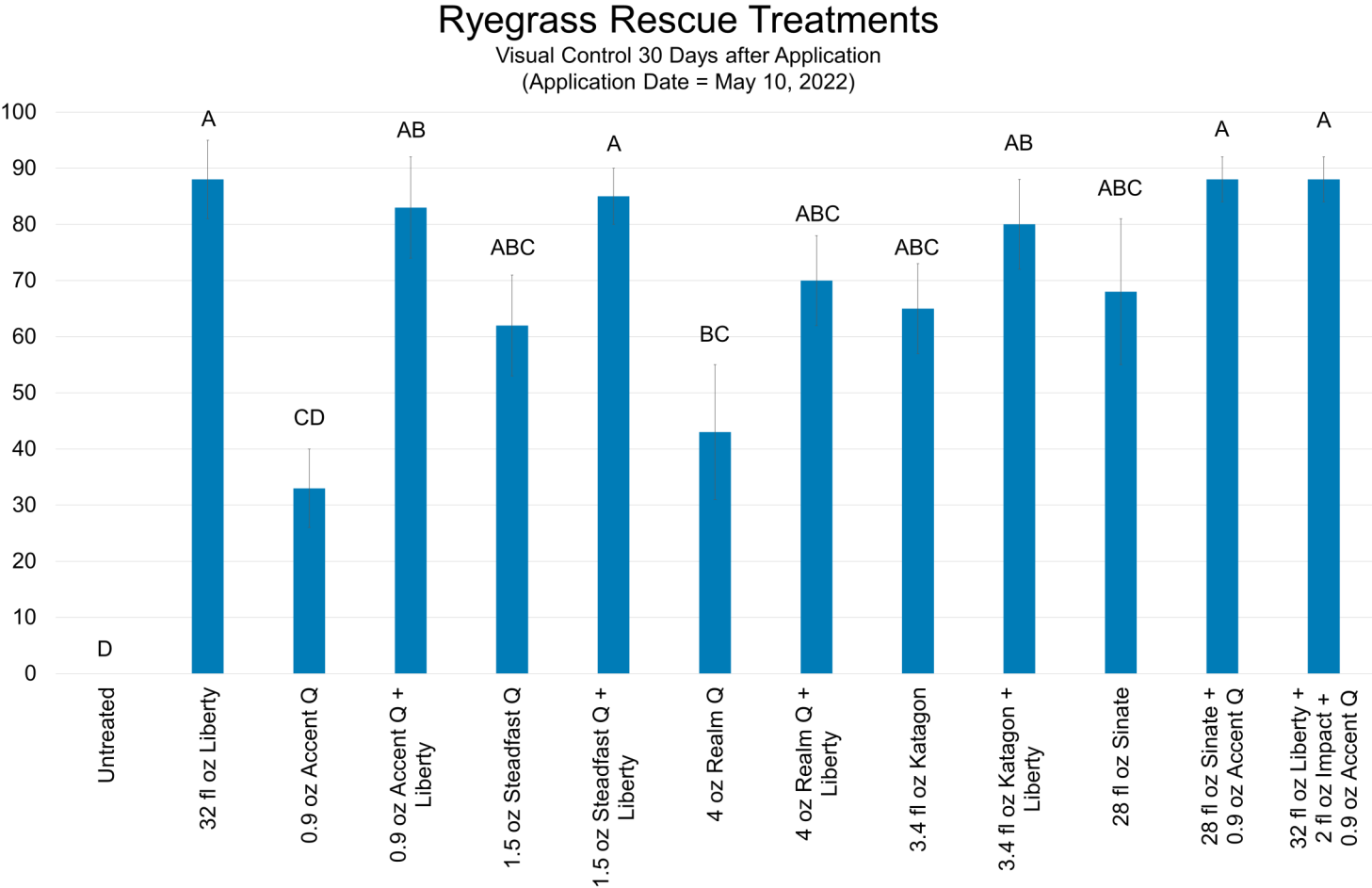
Of the options available in emerged corn, glyphosate is still considered the best option for populations that are still glyphosate susceptible. The key with glyphosate is to apply a rate of at least 1.5 lb ae/a for successful ryegrass control. We have found that in most cases of ryegrass escapes the initial burndown did not contain a high enough rate of glyphosate. Premix products with glyphosate can also provide control of susceptible ryegrass, although these mixtures often do not provide the needed rate of glyphosate and will need to be supplemented with additional glyphosate to reach the 1.5 lb ae/a rate.

Nicosulfuron is the best ALS-inhibitor for control of ryegrass, although overall control from nicosulfuron on large ryegrass will likely be fair to poor. Nicosulfuron is best used on smaller ryegrass for the best chance of acceptable control.

Glufosinate, while not known for its control of grasses, may be the best option for those dealing with glyphosate-resistant ryegrass and have a Liberty Link corn hybrid. A study conducted in 2022 observing rescue treatments on large ryegrass (18 to 24" in height) in emerged corn showed that treatments containing glufosinate resulted in the greatest control. Treatments that contained either 32 fl oz Liberty alone, Liberty plus Accent Q, Liberty plus Steadfast Q, Liberty plus Katagon, or Sinate plus Accent Q all resulted in 80% or better control of ryegrass 30 days after treatment. All these treatments contained glufosinate or a combination of glufosinate plus nicosulfuron. The results from all

treatments in the study can be found in Figure 1. It should be noted, that in these cases the application did not necessarily keep the ryegrass from producing seed but did cease ryegrass growth and competition with the corn crop.

Figure 1. Percent Italian ryegrass control 30 days after rescue application applied to 18 to 24” tall plants



In the scenario in which the corn hybrid planted does not have Liberty Link traits and the ryegrass is glyphosate-resistant, the options are very limited. In this scenario the use of a nicosulfuron based product such as Steadfast Q or Katagon is the best option. Although, suppression rather than control should be the expectation for these products on large ryegrass plants.

Lastly, there may be another option that should be considered, especially moving forward. The availability of corn hybrids with the Enlist trait package seems to be on the increase in Kentucky which may provide an additional option. Enlist corn hybrids can be safely sprayed with Assure II herbicide which can provide control of ryegrass. We have not evaluated control of large ryegrass escapes in corn with Assure II, but having this as an option is encouraging.

Table 1. Effectiveness of postemergence corn herbicides on Italian ryegrass

Grouping	Trade Name	Active Ingredient(s)	Italian ryegrass Rating*
Glyphosate	Roundup PowerMax 3**	glyphosate	8
Glyphosate pre-mixes	Acuron GT	glyphosate + S-metolachlor + mesotrione + bicyclopyrone	7
	Enlist Duo	glyphosate + 2,4-D choline	7
	Halex GT	glyphosate + S-metolachlor + mesotrione	7
ALS -inhibitors (Group 2)	Accent Q	nicosulfuron	7
	Steadfast Q	nicosulfuron + rimsulfuron	7
	Resolve Q	rimsulfuron + thifensulfuron	5
Glufosinate (Group 10)	Liberty**	glufosinate	6
HPPD-inhibitor (Group 27) based products	Laudis	tembotrione	3
	DiFlexx Duo	tembotrione + dicamba	3
	Armezon or Impact	topramezone	2
	Armezon PRO	topramezone + dimethenamid-P	2
	Impact Core	topramezone + acetochlor	2
	Callisto	mesotrione	2
	Callisto Xtra	mesotrione + atrazine	2
ALS inhibitor plus HPPD-inhibitor	Katagon	nicosulfuron + topyralate	7
	Realm Q	rimsulfuron + mesotrione	6
Glufosinate plus HPPD-inhibitor	Sinate	glufosinate + topramezone	6

* Rating scale: 8 to 9= good control; 6 to 7= fair control; 5 or less = poor control

** Numerous generic formulations are available

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KATS Soil Properties Workshop



The Kentucky Agriculture Training School (KATS) is hosting a workshop on how soil properties impact water and nutrient delivery to plants. This hands-on workshop will be held on **June 6** at the UK Research and Education Center in Princeton.

UK specialists will be joined by Jerry McIntosh, an NRCS Resource Soil Scientist, where they will visit two contrasting soil pits that represent a majority of the soil resources utilized for crop production in western Kentucky. Specific topics discussed will include profile properties such as soil texture, soil structure, nutrient distribution, soil organic matter, and plant available water. Classroom discussions after lunch will cover topics like soil test values, comparisons of laboratory results and recommendations, and how different management practices influence soil health parameters. Finally, the use and application of the NRCS Web Soil Survey program will be discussed.

“This training will cover many fundamentals necessary for producing a successful crop.” said Edwin Ritchey, UK Extension Soil Specialist.

Pre-registration is required at <https://KATSoilpropertiesworkshop2024.eventbrite.com> and will be open until June 3rd. The cost is \$105 and Certified Crop Advisors credits have been applied for.

Lunch will also be provided. For questions contact Lori Rogers, lori.rogers@uky.edu 270-365-7541 ext 21317.

Lori Rogers

KATS coordinator (270) 859-562-1317 lori.rogers@uky.edu

2024 Pest Management Field Day scheduled for June 27 in Princeton

It's a great opportunity to stay informed and network with fellow professionals in the field. The University of Kentucky Pest Management Field Day will be held Thursday, June 27, 2024, at the UK Research and Education Center (UKREC) in Princeton. The annual summer event is specifically designed for grain crop producers and industry representatives to learn more about minimizing potential growing season obstacles.

Due to on-going construction at the UKREC, the field day will begin with introductions at 8:30 a.m. CDT at the Princeton First Baptist Church Christian Life Center, located at 300 W. Main St. Attendees can park at the church's designated parking lot directly behind the Christian Life Center at the intersection of West Market Street and North Cave Street. From there, a caravan will then proceed to the UKREC field plots to tour the latest pest management research being conducted by University of Kentucky Extension Specialists. The ongoing research provides the basis for recommendations regarding weed, disease and insect management decisions on Kentucky corn and soybean acres.

"This event is a great opportunity to learn more about the emerging and ever evolving pest in Kentucky grain crops and observe firsthand the wide breadth of research being conducted on pest management at the University of Kentucky," said Travis Legleiter, University of Kentucky Extension Specialist – Weed Science.

After the field day activities conclude around midday, attendees will return to the Christian Life Center to enjoy a free lunch. Pre-registration is encouraged to receive an approximate attendance number by June 20.

Pre-register online at <https://tinyurl.com/2j9y33md> or by calling the UKREC at (270) 365-7541, EXT. 22569 or email jason.travis@uky.edu.

Continuing education units for Certified Crop Advisors and Kentucky pesticide applicators will be available.



Pest Management Field Day

June 27, 2024

8:30 a.m. to 12:30 p.m.

Speakers and Topics

Travis Legleiter

- Waterhemp and Palmer amaranth management
- Soybean residual herbicides for management of *Amaranthus* species
 - Maximizing metribuzin in soybean
- Postemergence soybean herbicide programs across HR trait platforms
 - Corn herbicide programs

Kiersten Wise

- Corn disease update

Carl Bradley

- Soybean disease update

Weed Science and Plant Pathology Graduate Student Project Updates

Sign-in begins at 8:00 a.m. CDT at Princeton First Baptist Church Christian Life Center located at 300 W. Main St. Parking is available at the church lot on West Market Street. A caravan will proceed to UKREC for field plot tours.

A **free lunch** will be provided. Pre-registration is recommended by June 20. Pre-register online at <https://tinyurl.com/2i9y33md> or by scanning QR Code; calling the UKREC, (270) 365-7541, EXT. 22569, or email jason.travis@uky.edu.



Continuing Education Units for CCA and KY Pesticide Applicators are pending

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Disabilities
accommodated
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2024 CORN, SOYBEAN & TOBACCO FIELD DAY



SAVE THE DATE

July 23rd

UKREC Farm

Princeton, KY



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KATS Crop Scouting Workshop

May 21, 2024

KATS Soil Properties & Their Impact on Delivering Water & Nutrients

June 6, 2024

Drone Pilot Certification Workshop (Madisonville)

June 10 & 11, 2024

Pest Management Field Day (IPM Grain Crops)

June 27, 2024

CORN, SOYBEAN & TOBACCO FIELD DAY

July 23, 2024

KATS Field Crop Pest Management & Spray Clinic

August 29, 2024



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