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Management of Soybean Cyst Nematode Starts with Soil Sampling this Fall or Spring

The soybean cyst nematode (SCN) (Figure 1) causes greater annual yield losses in Kentucky than any other pathogen of soybean. The last time a formal survey was conducted by the University of Kentucky in 2006 and 2007, approximately 76% of soybean fields in the state were infested with SCN. Preliminary results from an on-going SCN survey initiated in 2019 show that approximately 80% of Kentucky fields are infested with SCN. Although above-ground symptoms (stunting and yellowing) caused by SCN can occasionally be observed, affected soybean plants generally appear to be healthy. Unfortunately, "healthy-looking" soybean plants that are infected by SCN can still have up to a 30% yield reduction.

Figure 1. Females of the soybean cyst nematode (white colored lemon-shaped objects attached to roots in a red circle) infecting soybean roots. (Photo by Carl Bradley).

Management of SCN has gotten much more complex in the last few years, since SCN populations have adapted to the use of SCN-resistant soybean varieties. The primary source of SCN resistance used by commercial soybean breeding programs came from a soybean germplasm line known as "PI 88788". This source of resistance was highly effective in managing SCN for several years, but prolific use of soybean varieties with the PI 88788 background has selected for SCN populations that are able to overcome this source of resistance. In the 2006-2007 University of Kentucky SCN survey, the PI 88788 source of SCN resistance was not very effective against approximately 60% of the SCN populations in Kentucky, making management of this pathogen much more complex than before.

As complex as it is, management of SCN is still doable, and is important for maintaining and increasing soybean yields. Below are the main steps for managing SCN:

- **Test your fields to know the number of SCN eggs in your field**. The best times to sample for SCN in your fields is in the Fall or in the Spring (before planting). A Fact Sheet on sampling for SCN is available here: https://plantpathology.ca.uky.edu/files/ppfs-ag-s-09.pdf. Although the University of Kentucky does not currently have an active SCN Laboratory, samples can be sent to either the University of Illinois Plant Clinic (https://web.extension.illinois.edu/plantclinic/) or the University of Missouri SCN Diagnostics Lab (https://scndiagnostics.com/). Similar to the past two seasons, the Kentucky Soybean Board is continuing to sponsor free SCN testing for Kentucky farmers. With this program, a limited number of samples for each county can be tested for free. Please check with your local County Extension Office for more information about the limited free SCN testing program.
- **Rotate resistant varieties**. If varieties are available that utilize sources of SCN resistance other than PI 88788 (such as Peking or Hartwig), then rotate the source of resistance every time you plant soybean in a field. Unfortunately, nearly all the soybean varieties adapted for planting in Kentucky utilize only the PI 88788 source of resistance. However, it is still important to rotate to different resistant soybean varieties, even though they are utilizing the same source of resistance. SCN is good at adaptation, so switching soybean varieties will help.
- **Rotate to non-host crops.** Rotating fields to a non-host crop, such as corn or grain sorghum, will help reduce SCN populations in fields. Wheat is another non-host crop that may help lower SCN populations by having it in the rotation. Several years ago, Dr. Don Hershman with the University of Kentucky evaluated the effect of wheat residue on SCN populations. His research found that planting soybeans into fields with standing wheat stubble reduced SCN populations at the end of the growing season. More information about that research can be found here: https://plantpathology.ca.uky.edu/files/ppfs-ag-s-08.pdf
- **Consider using a nematode-protectant seed treatment**. Several nematode-protectant seed treatment products are now available on the market. Although the effects of these seed treatments have not always been consistent in field research trials, they are additional tools that can be used along with resistant varieties and crop rotation to help manage this important pathogen.

A multi-state initiative funded by the Soybean Checkoff Program known as the SCN Coalition is helping to promote awareness of the damage caused by SCN and the importance in managing this pathogen. More information about the SCN Coalition is available on their website at: https://www.thescncoalition.com/. Be on the lookout for information from the SCN Coalition about this important pathogen.

References

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Brown Marmorated Stink Bug Increases its Numbers in Western KY Soybeans in 2021

Stink Bugs in Kentucky

Stink bug species (Hemiptera: Pentatomidae) are present in soybean fields in Kentucky. They include phytophagous species such as green stink bug (*Chinavia hilaris*), the complex of brown stink bugs (i.e., *Euschistus variolarius, Euschistus servus*), southern green stink bug (*Nezara viridula*), brown marmorated stink bug (*Halyomorpha halys*) and red shouldered stink bug (*Thyanta custator*); as well as predacious species such as the spined soldier bug (*Podisus maculiventris)* and the roughed stink bug (*Brochymena* spp.) (Figures 1a and 1b). The phytophagous stink bugs are known to damage beans, especially during the reproductive stages.

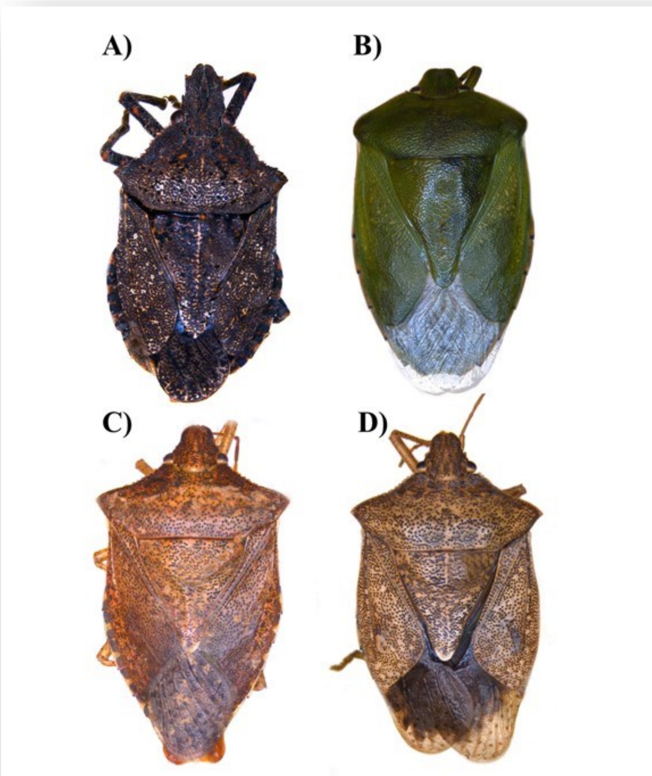

Figure 1a. (A) rough stink bug, (B) green stink bug, (C and D) two distinct brown stink bug species. (Photo by Armando Falcon-Brindis)

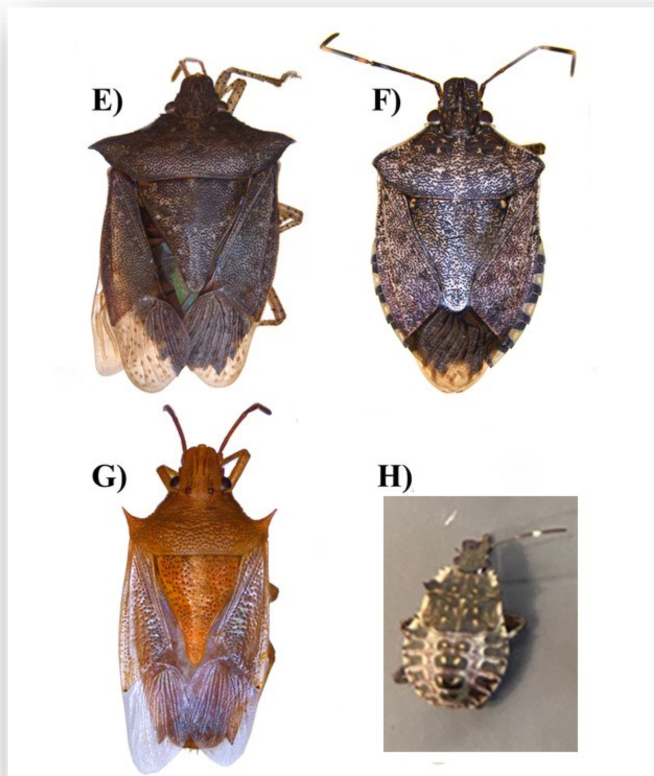

Figure 1b. (E) soldier spined stink bug, (F) brown marmorated stink bug, (G) rice stink bug, and (H) brown marmorated stink bug nymph. (Photo by Armando Falcon-Brindis)

Adult and immature stink bug stages feed on plant fluids by piercing the tender terminals and developing pods causing direct damages to beans. Such injuries may cause poor seed formation, seed abortion, reduced seed size or seed deformation. Therefore, it reduces yield and quality of beans.

Scouting in 2021

This article reports only on findings on stink bug numbers and species in western Kentucky counties and compared these numbers with data collected in 2020. Since mid-August 2021, we conducted tallies in nine western Kentucky counties and one central Kentucky county including Ballard, McCracken, Caldwell, Livingston, Lyon, Trigg and Christian counties, and research plots at the University of Kentucky's Research and Education Center (REC), Murray State University and the Western State University in Caldwell, Calloway, and Warren counties, respectively. In each location we recorded if the soybeans were full season or double crop and conducted tallies using 20 sweep nets per site on 5 or 6 locations per farm. Preliminary results of these findings are reported below.

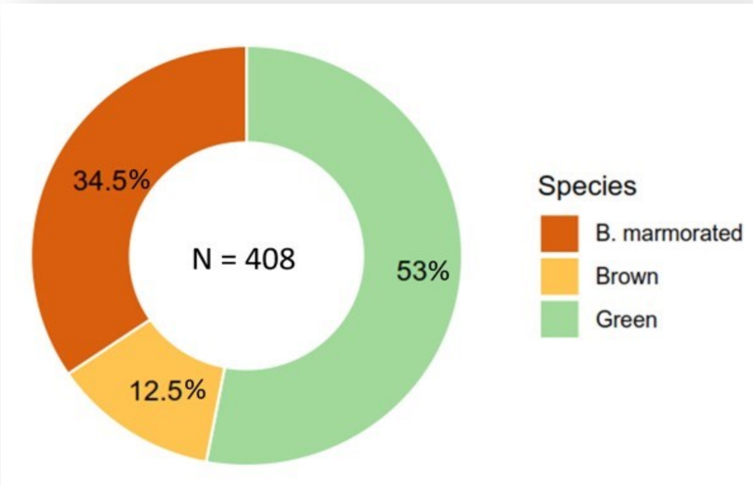

Figure 2. Percentages of the three most recurrent stink bug species tallied in 9 counties. Tallies were completed using sweep nets during the last two weeks of August.

Results and Discussion

In 2020, we reported about the [expansion of the brown marmorated stink bug in western Kentucky]. In this occasion we have observed that this trend continues with percentages of the brown marmorated stink bug rising to 34.5% in 2021 (Figures 2 and 3) vs. the 13.9% obtained in 2020. Also we are noticing that counties in western Kentucky that are near the Ohio river (Ballard, McCracken) increased their numbers, as well as personal communication reports on high numbers of brown marmorated stink bugs overwintering in human dwellings during the 2020 -2021 winter season compared to Lyon or Caldwell counties.

Figure 3. Two brown marmorated stink bugs (yellow arrows) in a recent picture taken in Ballard County. Feeding on pods reduce seed quality and yields (Photo Raul T. Villanueva).

Figure 4. Green stink bugs mating on soybean at the UKREC (Photo Armando Falcon-Brindis).

The most abundant species is still the green stink bug, which was frequently seen mating on the soybean leaves during mid and late August (Figure 4).

The augmented abundance of the brown marmorated stink bugs in Western Kentucky may bring changes in the management of this group of pests in soybeans, corn or horticultural crops. There are reports that this species as well as the invasive redbanded stink bug, *Piezodorus guildinii,* are more resistant to pyrethroids than endemic stink bugs (green and brown stink bugs). The redbanded stink bug is not reported in Kentucky but its presence in states around the Gulf of Mexico showed significantly higher levels of resistance to commonly used insecticides and seed damage compared with endemic species. Furthermore, the brown marmorated stink bug also affects sweet corn, and many other horticultural crops and is a nuisance in human dwellings as it overwinters inside causing stains on walls, irritations or allergies.

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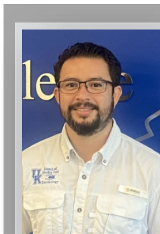

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Conserving/Maintaining Residual Nutrient Availability - Important with High Fertilizer Prices

A fall soil fertility program remains expensive. The latest DTN retail price survey https://www.dtnpf.com/agriculture/web/ag/crops/article/2021/09/08/potash-price-increases-slow-farmers has urea (46-0-0) at $557/ton, DAP (18-46-0) at $697/ton and potash (0-0-60) at $571/ton. This gives $0.605/lb N, $0.52/lb P_2O_5 (after the N value in DAP price was accounted for) and $0.475/lb K_2O. This means that residual field soil nutrients are especially valuable. Holding these nutrients in place, and keeping them bioavailable to plants, is important.

Figure 1: Cover crop wheat no-tilled into corn residues. Fall, 2018.

Residual nutrients can come in several forms. Many are held on/within soil mineral particles, especially soil clays, and soil organic matter. Another large reservoir is the mass of crop residues laying at the soil surface. Finally, the living plants (usually weeds) that are present may also be a significant part of the field's residual nutrient pool. Conserving/maintaining the nutrients contained in all these reservoirs will reduce future fertilizer need/cost.

Lost nutrients can result from simple physical movement (erosion and leaching). Lower nutrient availability is usually caused by chemical and biological nutrient transformations over time. Fall field management can accelerate or decelerate nutrient loss/lower nutrient availability. Prioritize field management practices according to the expected modes of lost nutrient value. As a first cut, we consider erosion the larger problem on sloping fields and leaching/nutrient transformation the greater problem on relatively level fields.

On sloping fields, water runoff, soil erosion, and nutrient loss are enhanced by fall tillage and/or crop residue mowing/chopping. Tillage "sizes" and incorporates crop residues and weeds, loosens the soil surface, and breaks up soil aggregates. Residue mowing/chopping behind the combine further breaks up crop residues. Both these practices result in larger quantities of erodible mineral and organic materials and facilitate erosion losses of those nutrients.

On both sloping and level fields, mixing of the soil with tillage can accelerate chemical fixation of banded or surface applied P and K, reducing their availability. Chopped crop residues are more easily degraded/mineralized, accelerating release and transformations of N, P and S at a time when those nutrients might not be taken up by a growing crop and could be lost.

A winter cover crop can be used to reduce soil erosion potential and hold nutrients that might otherwise be leached below the root zone or transformed to less bioavailable forms, regardless the tillage or residue management. Manipulating the termination timing can help manage availability of nutrients contained in the cover crop to optimally benefit the following cash crop. Nutrient release is generally more rapid when cover crops are in vegetative growth stages, slowing as the cover crop progresses towards maturity. Time termination according to the following cash crop's nutrient needs.

Finally, check soil pH. Soil pH is an important determinant of nutrient bioavailability, both in terms of crop health for good nutrient acquisition and the nutrient's chemical status in the soil. Important examples of nutrients that are greatly influenced by soil pH include P and Zn. Good quality fall-applied agricultural lime will have time to reduce soil acidity, raise soil pH and improve soil nutrient bioavailability.

Conserving/maintaining residual nutrient availability is a matter of holding on to the nutrients you have and maintaining or improving their value (i.e., their availability) to the next crop. Proper pH management is important. Reducing fall tillage and residue chopping, coupled with a cover crop to reduce runoff and erosion, will slow particulate nutrient losses, crop residue decomposition and soil nutrient fixation, further conserving residual nutrient availability.

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Abundance of Sugarcane Aphid was reduced in Sorghum in 2021

Grain, forage, and sweet sorghum can be affected by several species of aphids. The **yellow sugarcane aphid** (*Sipha flava*) (Figure 1) that has been known since 1884 and is thought to be a native species of the U.S. Yellow sugarcane aphid is well-distributed in North America, reaching from all states in the South to states bordering Canada to the north. Also, the **corn leaf aphid** (*Rhopalosiphum maidis*) can cause occasional problems to sorghum and in rare occasions treatments may be necessary.

In 2013, a new aphid arrived. This was a new strain of the **sugarcane aphid** (*Melanaphis sacchari*) (Figures 1 and 2), and since then has been considered the most important pest of sorghum due to its rapid population increase, excessive amount of honeydew that accumulates on leaves, and devastating damage to sorghum. From 2013 to 2016, many sorghum fields were completely lost, and yields were reduced to 40 to 60% of previous years averages.

Figure 1. Mixed populations of the sugarcane aphid (top image of insert) and the yellow sugarcane aphid (bottom image of insert) in sweet sorghum. The yellow sugarcane aphid (red circles) has a bright yellow coloration and abundant hairs (insert) that helps with its identification. (Photo: Raul T. Villanueva, UK)

Figure 2. Forage sorghum in Princeton in 2020. Damage caused by sugarcane aphids were observed in many of the cultivars planted in 2019 and 2020. However, in 2021 plants were not infested and populations were low. (Photo: Raul T. Villanueva, UK)

Status of Aphids in Sorghum in 2021

In June, the yellow sugarcane aphid was present in some forage and sweet sorghum fields causing typical damage (i.e., yellow coloration of lower leaves).

In July, both yellow and sugarcane aphids were present in sweet and forage sorghum, but the population did not pass economic threshold levels. However, the population of sugarcane aphids by the end of July and beginning of August in organic sweet sorghum were above threshold levels in Trigg County. These populations were present when plants were almost ready to be harvested. In conventional sweet sorghum, a single application of *flupyradifurone* (Sivanto™ 200 SL) effectively controlled this pest. Whereas, at the University of Kentucky Research and Education Center at Princeton, an experimental field of forage sorghum only had sugarcane aphids on border rows. Although intentional infestations were conducted collecting sorghum leaves with heavy infestations of sugarcane aphids from an infested field and transported and released into the research plots, the population of sugarcane aphids in the REC did not increase.

In Lyon County, a grain sorghum field had some light infestations of corn leaf aphids by early August; however, they were effectively controlled by natural enemies by mid-August (Figure 3 and 4). By the beginning of September sugarcane aphids were only present on the edges of the field and populations did not increase.

Figure 3. Corn leaf aphid colony controlled by parasitoids and by predators. Notice the exit holes in parasitized aphids and the pink ladybug preying on them. (Photo: Susan Fox)

Figure 4. An egg of a syrphid or corn fly oviposited on lower surface of sweet sorghum surrounded by different life stages of the sugarcane aphid. When the egg hatches a predacious syrphid larva will prey on the aphids. (Photo: Raul T. Villanueva, UK)

Why Sugarcane Aphid Populations Are Low in 2021

The reasons for the low population of the sugarcane aphid (*M. sacchari*) might be explained by two important facts or a combination of both.

First, natural enemies may be effectively controlling this pest after almost 9 years of exposure to the presence of sugarcane aphids. Based on my own experience, I can affirm that from 2013 to 2016 the abundance of predators in sorghum fields were unbelievably high; however, population outbreaks of the sugarcane aphid escaped predation or parasitism.

Second, farmers and consultants are using effective insecticides for its management and applying these products at the correct time. The latter is happening with Amish farmers in Cerulean, Kentucky; this community has been using the most effective insecticide since 2018 and modified their spraying tools to control this pest.

Also, I have received information from colleagues in South Texas that observed similar management practices to control this pest (using the most effective insecticides and appropriate time of application), as well as the increased effectiveness of the natural enemies.

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