2021 Soybean Science Research Report

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Evaluating Sunflower as a Trap Crop for Dectes Stem Borer in western Kentucky

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Introduction

The stalk borer *Dectes texanus* LeConte (Coleoptera: Cerambycidae) is an endemic long horned beetle (Fig. 1) that feeds on soybeans. This species can cause losses to soybean production across many soybeans grown areas of North America. The larvae feed on the pith of soybean stems (Fig. 2) during its development. This damage debilitates the plant and can cause lodging, which can be most likely on windy events or rain.

Figure 1. *Dectes soybean stem borer* adult in laboratory cages. (Photo: Raul T. Villanueva)

Figure 2. Larva of *Dectes texanus* in soybean stalk. (Photo: Armando Falcon-Brindis).

Previous works have proposed the use of sunflower as a trap crop to reduce the attacks of the soybean stem borer in Kansas (Michaud & Grant 2005, Michaud et al., 2007). In those studies, they found that sunflower attract *Dectes* and soybeans in rows closer to sunflowers had higher *Dectes* populations than distant plants from sunflower plants. The objective of this study was to evaluate if sunflowers can be a trap crop in soybeans in Kentucky.

Materials and Methods

From August to October 2021, the attack incidence of *D. texanus* on soybean and sunflower was evaluated in two experimental fields at the University of Kentucky Research and Education Center, at Princeton.

Sampling was conducted every 2 weeks, collecting soybean plants from the middle and border at 0.5, 5, 10, 20, 50, 100 and 200 m away from the sunflowers (Fig. 3). Both sunflowers and soybean plants were pulled out and taken to the laboratory for further inspection. Stalks and branches were carefully opened to observe and quantify the presence of Dectes larvae.

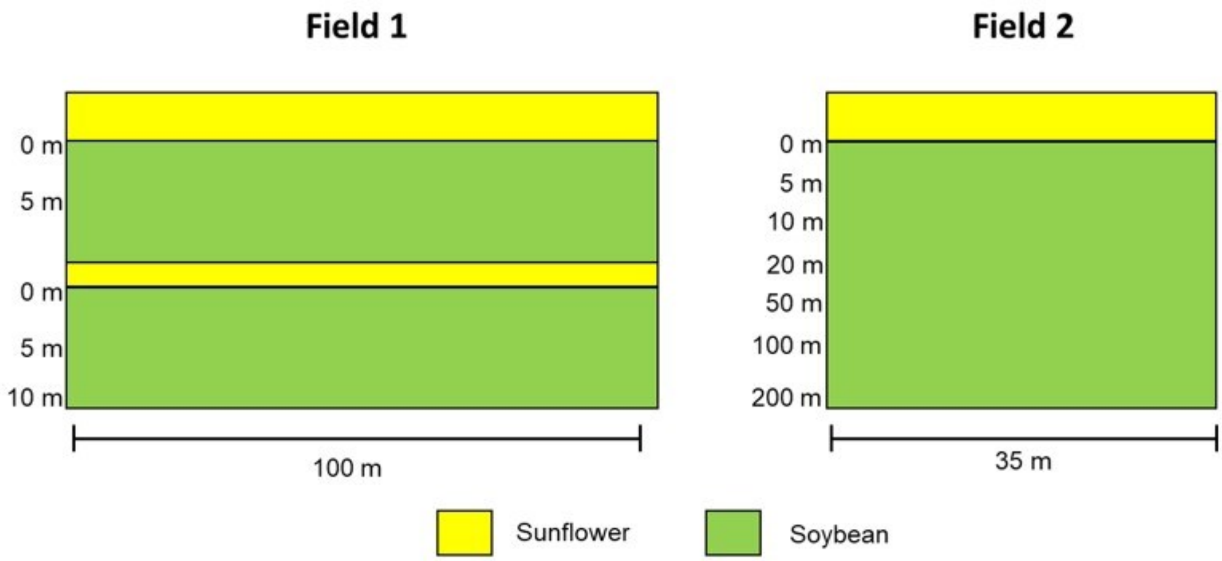

Figure 3. Schematic design of each field set up indicating the distances at which samples were collected.

Results

The numbers of *D. texanus* in soybean stalks and branches decreased as the distance to sunflower increased; the lowest incidence of *D. texanus* on soybean stalks was found at 200 m away from the sunflowers (Fig. 5).

Within the sunflowers, the red cocklebur weevil *Rhodobaenus quinquepunctatus* (Coleoptera: Curculionidae) was found colonizing the stalks. This beetle feeds on many weed species but on soybeans. The red cocklebur weevil was found in larger proportions (86%) than *D. texanus* in sunflower plants (Fig. 5).

Larvae of *R. quinquepunctatus* colonized the sunflowers earlier than *D. texanus* (Fig. 6a). The former species fed on most of the pith of sunflower in the lower half of the plant (Fig. 6b). Pupation occurred at the root and then adults chewed their way out of the plants (Fig. 6c).

Conclusion

Our results differed from the studies in Kansas. In sunflowers we did not detect high numbers of *D. texanus* as it occurred in Kansas however, the numbers of *D. texanus* decreased as the samples from soybean plants are distant from sunflowers as it happened in Kansas. In Kentucky there is a key interaction between two species that explains this difference. The interaction between *D. texanus* and the red cocklebur weevil was previously unknown until 2020 (Villanueva, unpublished). It appears that the red cocklebur weevil restricts the success of *D. texanus* larvae inside the sunflower stalks. Therefore, the use of sunflower as a trap crop may be interfered by this competitive relationship in a positive manner. Although sunflower is an attractive host to *D. texanus,* the cocklebur weevil colonizes the plants earlier, thus restraining *Dectes* to complete its life cycle and finally causing mortalities that may have not tallied in this study.

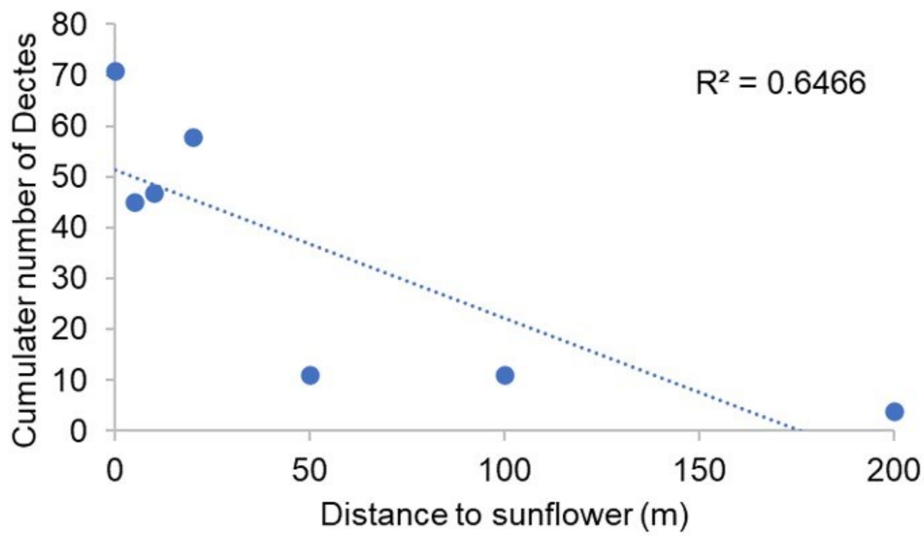

Figure 4. Total counts of *Dectes texanus* larvae found in soybean stems at different distances from sunflower field edge (See Figure 2: Field 2).

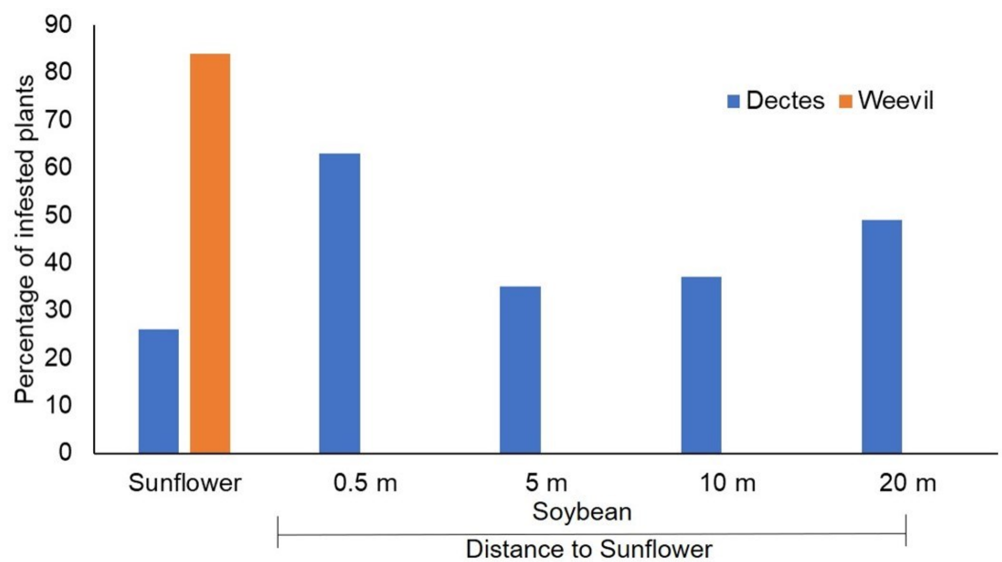

Figure 5. Percentage of infested plants by the cocklebur weevil (only sunflower) or Dectes at different distances from sunflower edge plot.

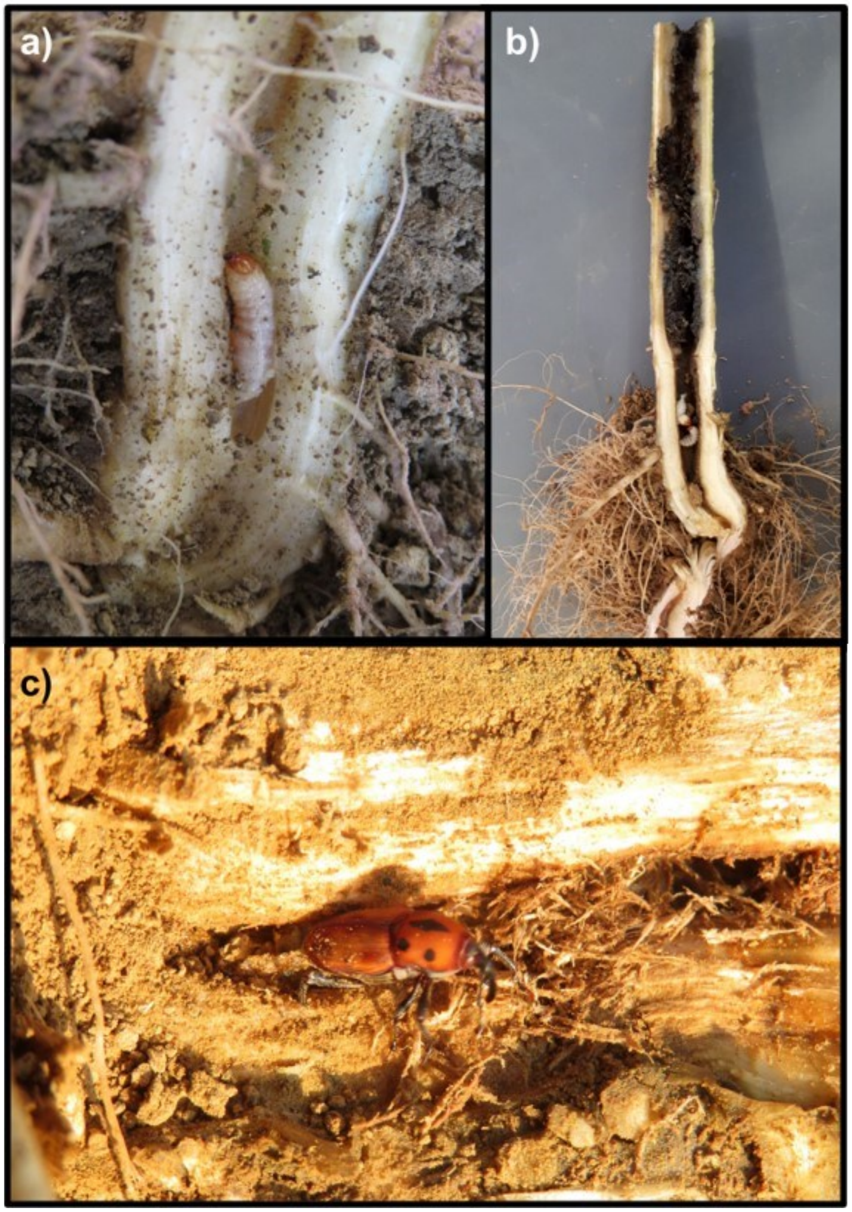

Figure 6. *Rhodobaenus quinquepunctatus* within sunflower stalks; a) immature larva, b) two larvae and their damage to the vascular system of the plant; c) adult. Photos: Armando Falcon-Brindis.

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Evaluating Molluscicides and Carabid Predation of Slugs in Soybeans

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Introduction

Slugs are well-known pests in gardens and high price products such as fruit and vegetables grown in greenhouses. However, in field crops such as soybeans and corn they are emerging pests. In soybeans, slugs feed on germinating seeds, seedlings and foliage causing reduction of plant densities or replanting. Slug outbreaks can reduce plant population densities and damage to plants beyond the point of recovery. Slugs become a major threat when temperatures are moderate and rains are present, usually in spring and into early summer. Slugs tend to be most active and thrive when weather conditions are cool and wet and they are very active at night. Slug damage is often mistaken for the damage of other pests like the bean leaf beetle or corn ear maggots. Oftentimes, when farmers notice slug presence in soybeans it is too late and there is no option other than replanting which can quickly become costly. It is important to recognize when slugs are in the fields so that preventative measures can be taken before damage becomes severe. Scouting for slugs should be done by farmers and crop advisors.

Figure 1. Different species of carabid beetles captured during summer 2021. Measurements in ruler are shown in inches and centimeters. Photo: Josey Tolley

There are several methods to manage slugs. As a biological control in Europe, nematodes are being used to control mollusks. However, this approach has not been used in the United States yet. Carabid or ground beetles are known to be predacious of slugs. This was tested this summer at the Research and Education Center in Princeton, KY. Several species of ground beetles were collected over the summer (Figure 1). A typical method for controlling slugs in vegetables or produce of high value is through applying molluscicides. The molluscicide baits 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 field at costs averaging $20/acre to avoid having to replant due to damage from slugs. 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. Finding a cost-effective way to prevent slug damage is proving to be a challenge for agriculturists because there is not reliable science-based information on treatments for the management of slugs in field crops. In this research, both field and laboratory studies were conducted, using molluscicides (pesticides for slug control) and analyzing the predatory behavior of ground beetles.

Objectives

There were several objectives analyzed in this project. They included:

- To study the population phenology of slugs in a soybean field.
- To study the populations of ground beetles in a soybean field, identify potential ground beetle predators of slugs, and evaluate their capability of preying on different developmental stages of slugs (eggs, immatures, and adults) in laboratory bioassays.
- To determine the effects of two molluscicides applied at two rates on slug populations in a soybean field.

Materials and Methods

Phenology of Slugs and Ground Beetles

Tallies on the population of slugs and carabid beetles were carried in a soybean field at the UKREC in Princeton, KY and comprehended a six-week period from 4 June to 23 July 2021. These tallies were conducted by searching for slugs and ground beetles on the surface in 4-ft row lengths and replicated 6 times on different randomized sites. Inspections consisted of uncovering organic debris left from the previous season and counting all slugs and carabids found there. The organic matter observed in this field was corn.

Field Study Using Molluscicides

This study was conducted in an experimental field at the UKREC. Research plots consisted of 4 soybean rows at 20 ft length. Molluscicides were applied along the 2 central rows and were applied through sprinkling by hand on May 18, 2021. This study had 4 replications in RCBD. The study lasted for 14 days, and data was collected 6 times over the course of the 14 days. Each of the 2 molluscicides were applied at the rate recommended by the manufacturer as well as a lesser rate. In addition to this, there was an untreated control plot.

Table 1. Molluscicides used and rates. Rates in bold are doses recommended by the manufacturer.

TREATMENT	RATE (Lbs/A)
Iron phosphate	20
Iron phosphate	**44**
Metaldehyde	5
Metaldehyde	**10**
Control	-

Predation of Slugs on Ground Beetles

All the studies conducted for this study were completed in the laboratory using 3cm in diameter Petri dishes. In the bottom of the Petri dish, a piece of filter paper was applied and moistened with 0.025ml of water. This was done to prevent the different developmental stages of slugs from drying out during the experiment. Slug eggs that were oviposited in the laboratory from a slug colony were used in the study. Also, recently emerged immature slugs, and adult slugs were all used in this project. Ground beetles in this project were starved for 24 hours prior to the experiments. Starvation was conducted by placing individual ground beetles in a Petri dish then placing them in a plastic container that was in a cooler containing ice. All set up procedures were conducted the same way for each developmental study. After the filter paper was applied to the Petri dish, whichever life stage of the slug being studied was applied next. For the slug eggs, 10 eggs were placed in 1 Petri dish. For immature slugs, 7 immatures were in 1 Petri dish. Finally, there was 1 adult slug per Petri dish. One ground beetle per Petri dish was the standard for all 3 of these studies. Figure 2 shows the complete set up of the ground beetle and slug egg study. An identification number was applied to each ground beetle so that data could be collected and added to their predation history and for posterior identification of the carabid species.

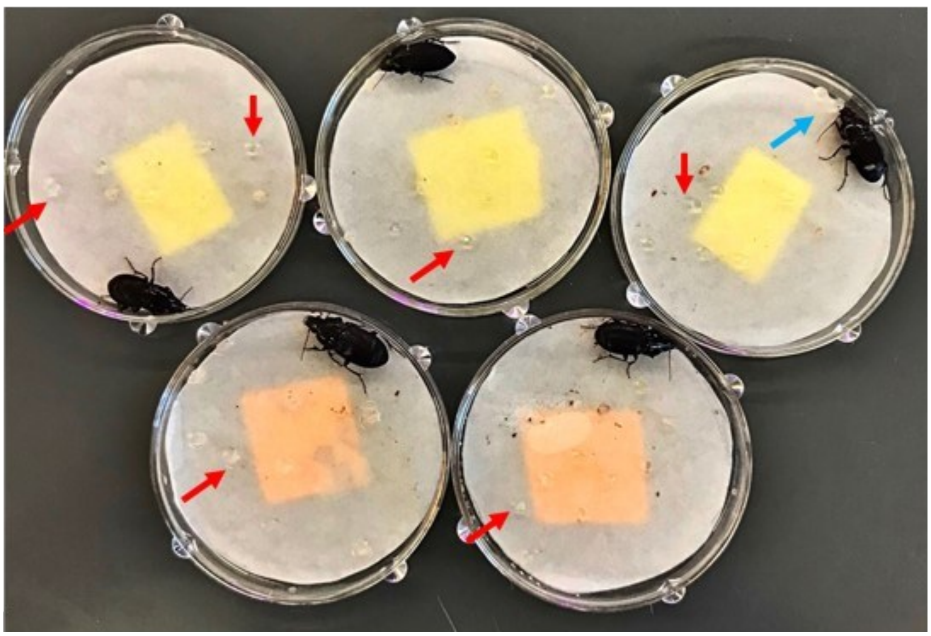

Figure 2. Overview of the ground beetle and slug egg study after completing all the set-up procedures. Eggs are a clear pearl shape shown by arrows. Blue arrow shows the instant a ground beetle is preying upon an egg.

Results and Discussion

Population of Slugs and Ground Beetles

Results on populations of slugs and ground beetles are shown in Figures 3 and 4, respectively. Both populations decline drastically around the same time. The slug population was not able to get above 1 slug per 4ft average for the rest of the study (Figure 3). Environmental conditions may have affected these trends, high temperatures and absence of rains are important for slug to move away from the soil surface looking for more moist conditions. Ground beetle species populations got back to its highest point around mid-July. Carabid beetles are polyphagous predatory species and when slugs are gone, they may be searching for other arthropod preys that increase during the summer months. (Figure 4).

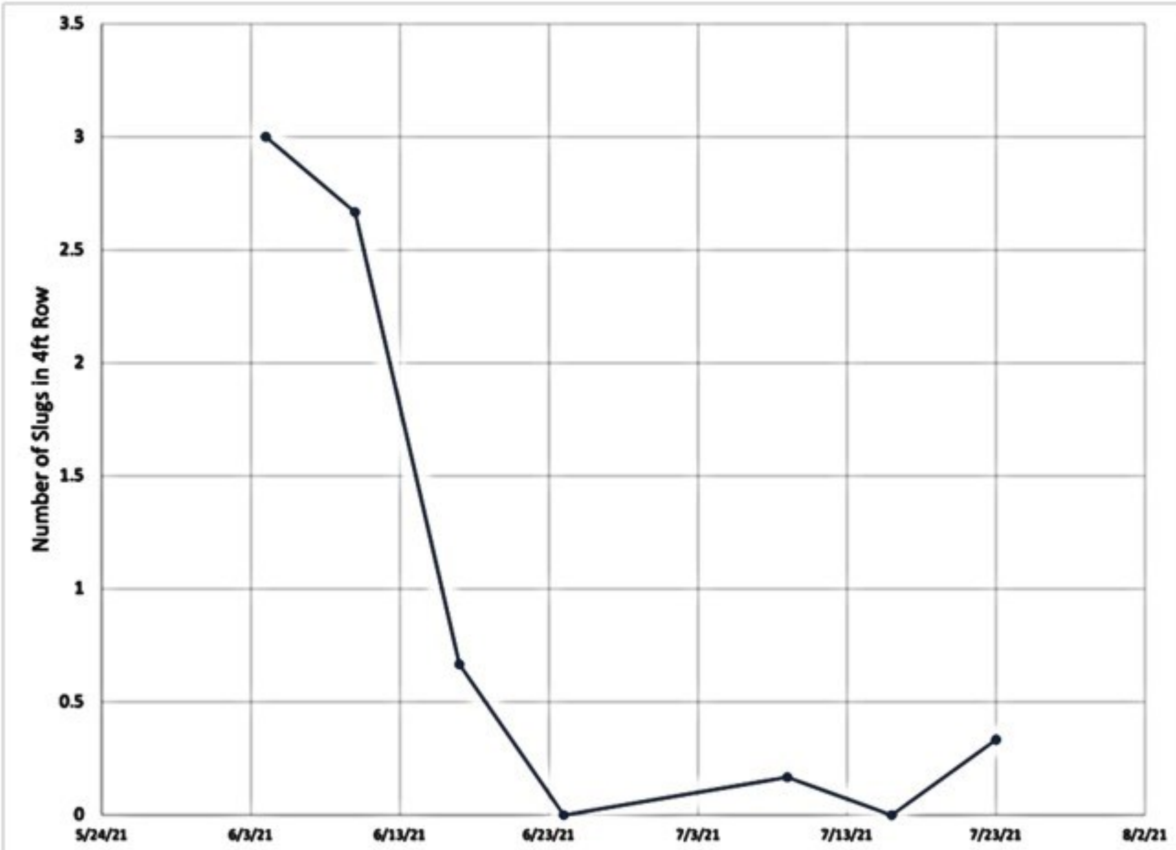

Figure 3. Average number of slugs in a 4ft row in a soybean field over 6 weeks in summer 2021.

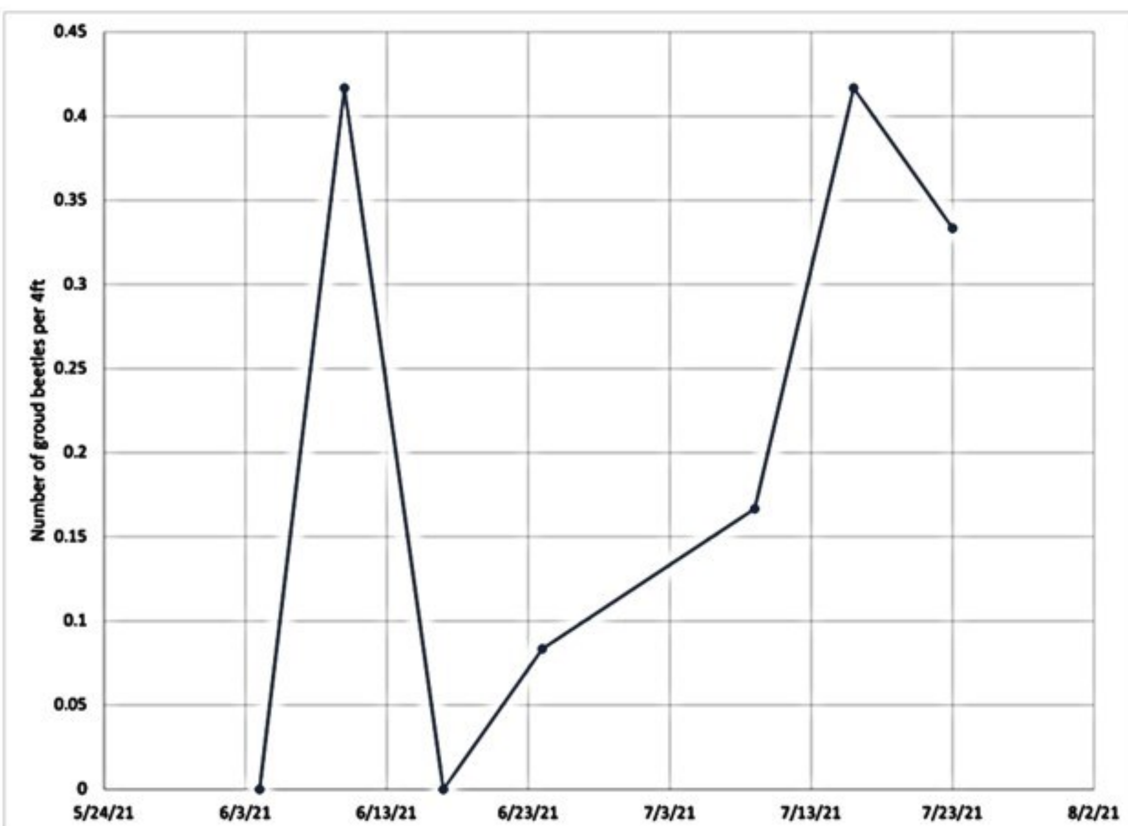

Figure 4. Average number of ground beetles in a 4 ft row in a soybean field over 6 weeks in summer 2021.

Field Study Using Molluscicides

Results of field application of molluscicides showed that the recommended rate of iron phosphate (44 lbs) was the most effective in decreasing the slug population (Figure 5). This treatment had the highest number of slugs in the plot after the molluscicide application, but then the number of slugs declined and by the end of the study, slugs were not found in any of these treated plots. The high number of slugs in the plot immediately after the molluscicide application could be due to attraction of the molluscicide baits. Baits might had attracted slugs to the application area and then did their job by killing the slugs after the molluscicide was ingested. The control might have a lower number of slugs at the beginning of the study because the slugs were attracted to baits and moved from these plots. However, by the end of the study the control had the greatest number of slugs. This also showed that molluscicide baits were effective because the slug populations in treated plots were lower than the control at the end of the experiment in all molluscicide treatments.

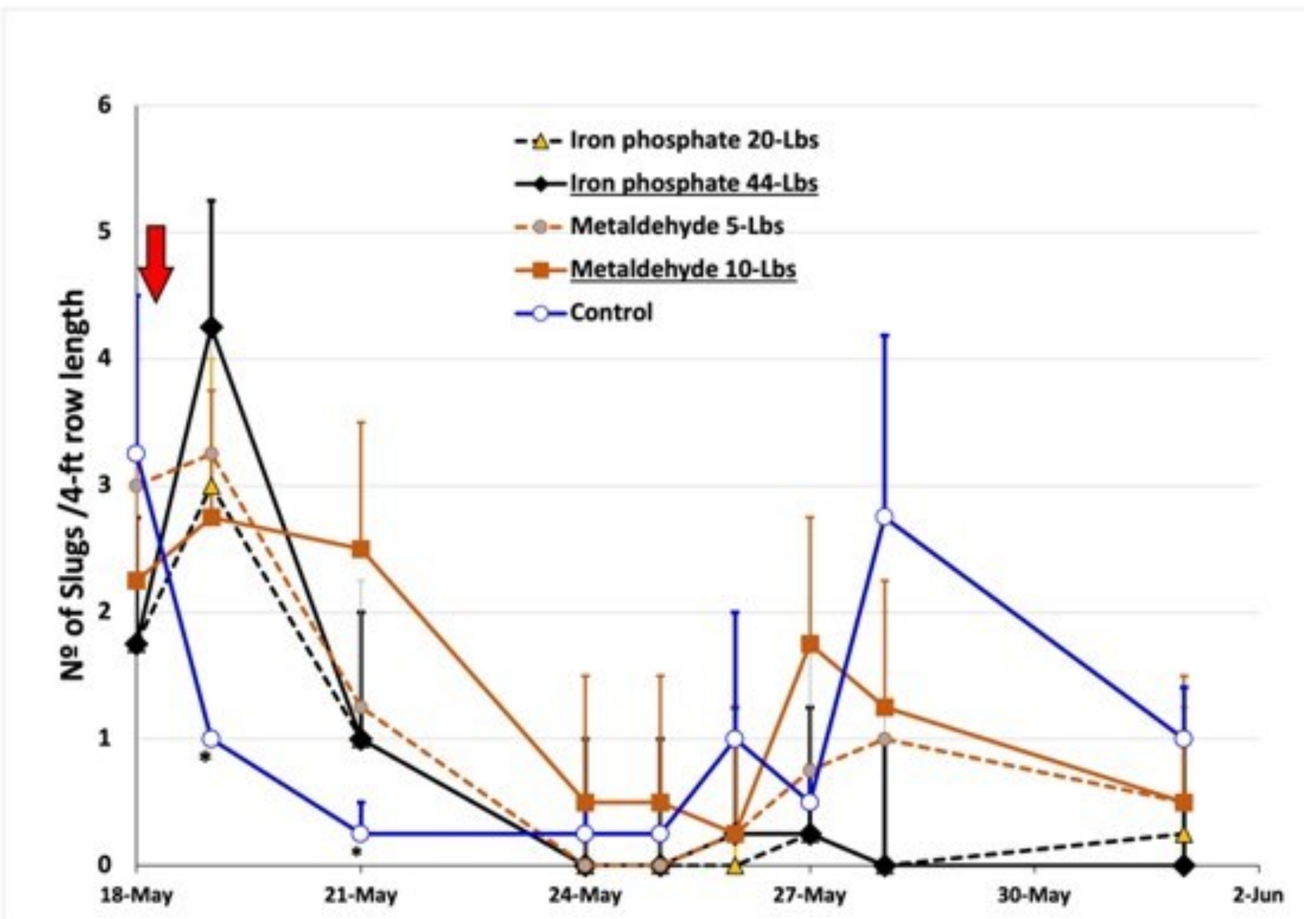

Figure 5. Mean (±SEM) slug numbers/4ft row lengths after molluscicide application (arrow indicates the time of the molluscicide application).

Predatory Study of Ground Beetles

Slug egg predation: the experiment with the ground beetles and slug eggs was replicated 5 times. Data were collected on the number of eggs consumed by carabid beetles at 24, 48, and 72 hours (Figure 6). By the end of 72 hours, all the beetles except for one specimen had fed on almost all the eggs allotted to them (Figure 6). The species of the ground beetles is currently still undetermined. However, one carabid beetle species that did not feed on slug eggs had a different aspect compared with the rest of the beetle species used in this study, and most likely this is a species of ground beetles that is not a predator of slugs. The rest of the ground beetles look very similar in size and structure, so they may be one or multiple species. Beetles will be sent to an ID specialist for identification. All these predatory carabids prey upon different growth stages of slugs.

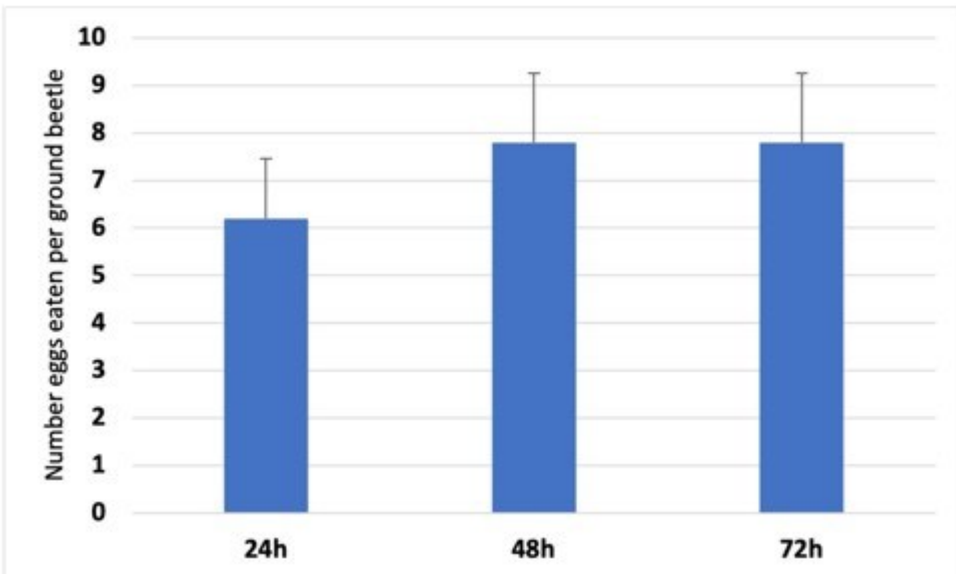

Figure 6. Mean (±SEM) number of eggs preyed on by ground beetles (n =5). at 24, 48, and 72 hours. (10 eggs per Petri dish)

Immature slug predation: the study with ground beetles and immature slugs was replicated 10 times. The beetles were allotted 7 immature slugs each. Data were collected at 2, 18, and 24 h after carabid release on Petri dishes (Figure 7). By the end of this study, almost every beetle had fed on all the immatures given to them. Figure 8 shows one of the ground beetle species used in the study preying upon an immature slug. All beetles in these studies were starved for 24 hours prior to the start of the study, so they preyed on more than half the immatures given to them in a 2 h window.

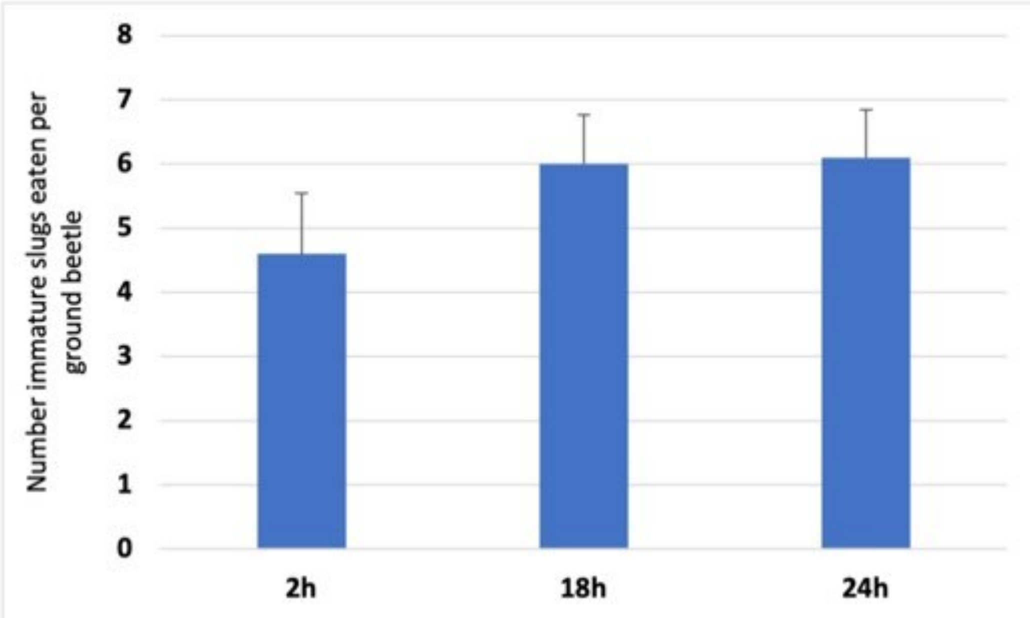

Figure 7. Numbers of immature slugs (±MSE) at 2, 18 and 24 h after the carabid beetle (*n* =10). was released (7 immature slugs per Petri dish).

Figure 8. Ground beetle feeding on immature slug. Photo: Josey Tolley

Adult slug predation: the study involving ground beetles and adult slugs was replicated 10 times. There was one adult slug given to each ground beetle. Data were collected at 24, 36, and 48 hours (Figure 8). Adult slugs and ground beetles are relatively the same size, so it is remarkable that the ground beetles can consume almost entirely an adult slug. At the end of the study, nearly all the beetles had eaten the 1 adult slug given to them.

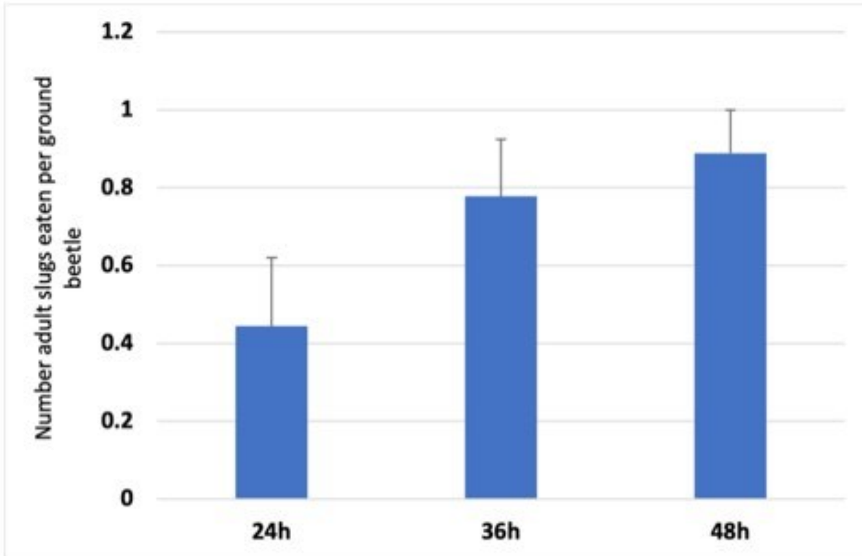

Figure 9. Mean (±SEM) of adult slugs preyed on by ground beetles (n =10). (1 adult slug per Petri dish)

Most of the beetles used in these 3 studies demonstrated predatory behaviors on slugs. As mentioned above, the exact species of these beetles have not yet been determined, but there are at least one or more species of ground beetles that are predators of all developmental stages of slugs. In addition, bioassays conducted using two or more carabid beetles per Petri dish and slugs resulted in predatory behavior of carabid species on their congeners.

Conclusion

Finding an effective and practical way to manage slug outbreaks in crop fields is still proving to be a challenge. These two studies have given us a baseline of what works and what does not work, but there is still more research to be done. Regarding the field study using molluscicides, the iron phosphate treatment seems to be more effective although significant differences between the applications were not observed. At 9-10 days after application, the number of slugs in the molluscicide plots were lower than the control plots. This means the molluscicides were effective in reducing slugs, but eventually another application may be needed to be more effective than a single application. Regarding the predatory behavior of ground beetles, the beetles used in this study are being sent to Pennsylvania to determine their species. Some species of the ground beetles portrayed cannibalistic behaviors in the laboratory colony, so that is why only 1 beetle was in each Petri dish. A couple of questions that arise from the ground beetle study are: how can we increase the population of predatory ground beetles in fields, would higher populations of ground beetles be enough to lower the population of slugs? And how insecticides affect these carabid beetles.

Acknowledgements

Funding for this project were provided by USDA-NIFA ELI-REEU 2017-06637 grant and the Kentucky Soybean Promotion Board. We would like to thank Christine Bradley, Caleb Whitney, and Avery Ritchey for their assistance during the progress of this research.

Description of the Rapid Colonization of western Kentucky by the Brown Marmorated Stink Bug 2020-2021

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Introduction

Every year, soybean farmers in Kentucky usually face the attacks of endemic common stink bugs: the green stink bug (*Chinavia hilaris*) and the complex of brown stink bugs (*Euschistus* spp.--i.e., *E. variolarius, E. servus*), and since 2010 the brown marmorated stink bug (BMSB, *Halyomorpha halys*) (Figs. 1A-C); the latter species was reported mainly in central and eastern Kentucky. The BMSB is an invasive species that was reported previously in many areas of western Kentucky but not in soybeans and corn, any other agricultural commodity or overwintering in man-made structures. These species are known to damage soybeans during summer and fall. Their damage on pods can cause aborted seeds and reduced economic value. However, when looking at the attack rates by these plant sucking hemipterans, the soybean planting periods (full season vs. double crop) can make a big difference on stink bug populations and species composition (Villanueva and Falcon 2021).

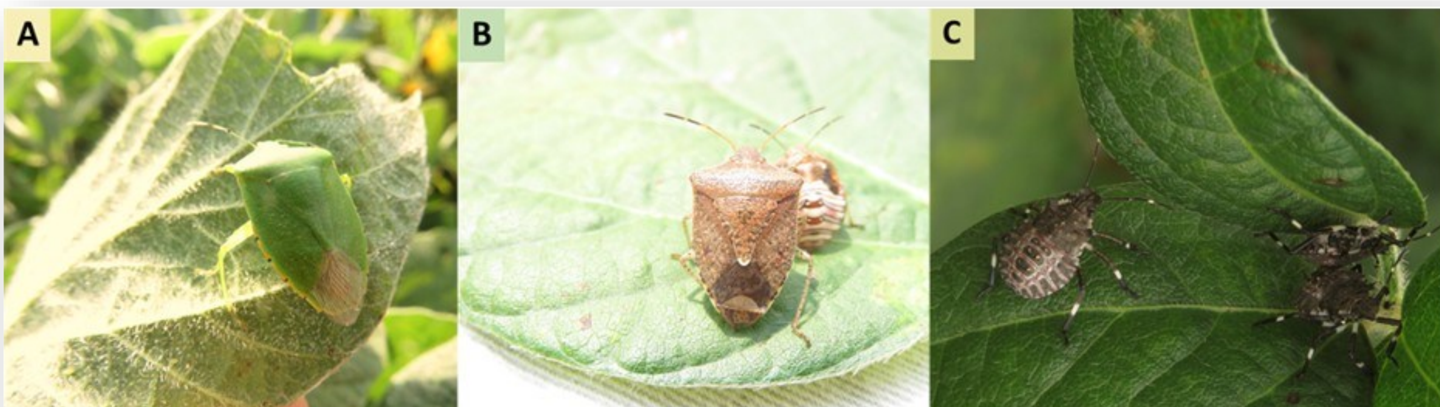

Figure 1. Common stink bugs found in soybean fields from west and central Kentucky. Green (**A**), brown (**B**) and nymphs of brown marmorated stink bugs (**C**) (Photos: Armando Falcon-Brindis, UK).

Since our first report of the expansion of the brown marmorated stink bug toward western Kentucky in 2020 (Villanueva and Viloria 2020), farmers and county Extension agents have been reporting increasing numbers of BMSB in western counties of Kentucky. The goal of this study is to evaluate the expansion and colonization of the brown marmorated in western Kentucky and assess the species composition of stink bugs.

Materials and Methods

We conducted standardized sampling (100 sweeps/field) in 34 commercial soybean fields from 21 counties in western and central Kentucky. In the western region, the counties sampled were Fulton, Hickman, Carlisle, Ballard, McCracken, Graves, Calloway, Livingston, Lyon, Caldwell, Christian, Trigg, McLean, and Henderson, whereas in the central region, we sampled in, Daviess, Hancock, Breckenridge, Hardin, Warren, Nelson, and Fayette counties (Fig. 2).

We focused on two aspects with the information obtained. First, we compared the proportion of the three most common stink bugs on soybeans: green, brown, and BMSB. Then, we examined whether the planting strategies (double crop vs. full season) could help explain the number of stink bugs. Tallies were conducted using sweep nets during August and September in 2020 and 2021.

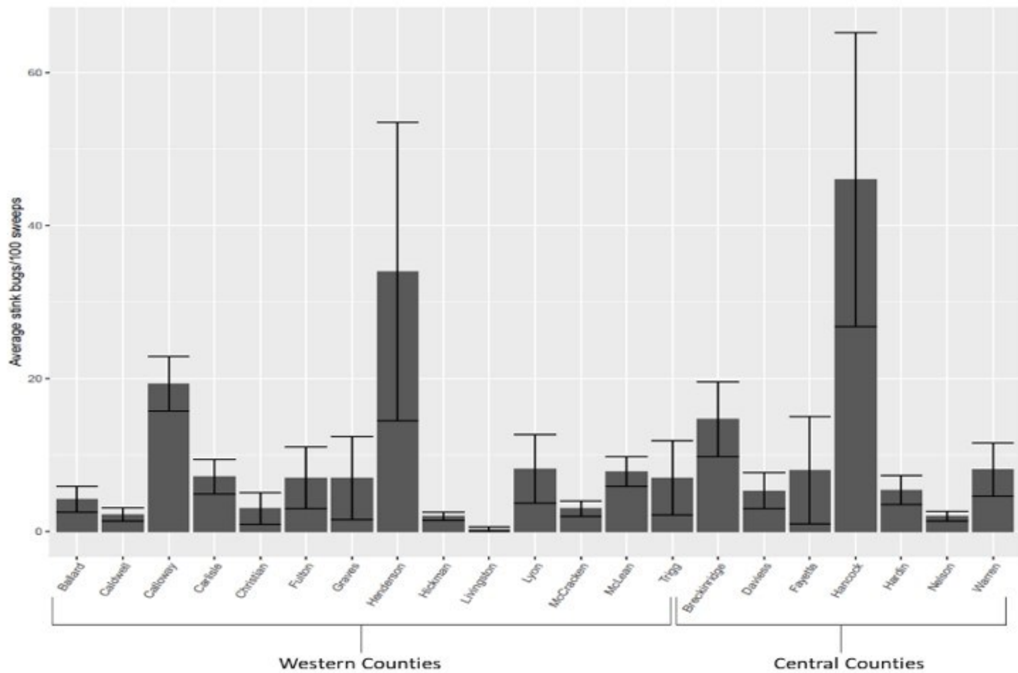

Figure 2. Numbers of stink bugs (Mean± SEM) across 34 commercial soybean fields in 21 counties. In Livingston County, we collected only one stink bug; the field might have been sprayed on days previous to when the tallies were conducted.

Results

We collected 1,112 stink bugs from western and central counties (Figures 2 and 3). The proportion between the green, brown, and BMSB was statistically different ($\chi^2 = 265.2$, df = 2, p<0.001). The total number of stink bugs varied according to the planting strategy (t = -3.01, df = 129.2, p = 0.003), where full season fields had more stink bugs than those planted as double crops (Figure 4). Interestingly, the proportion of these stink bug species from central and western counties is closely related ($\chi^2 = 1.18$, df = 3, p<0.552). Although the most abundant species is the green stink bug in double crop systems, the brown marmorated stink bug seems to be starting to dominate among full season fields (Figure 3).

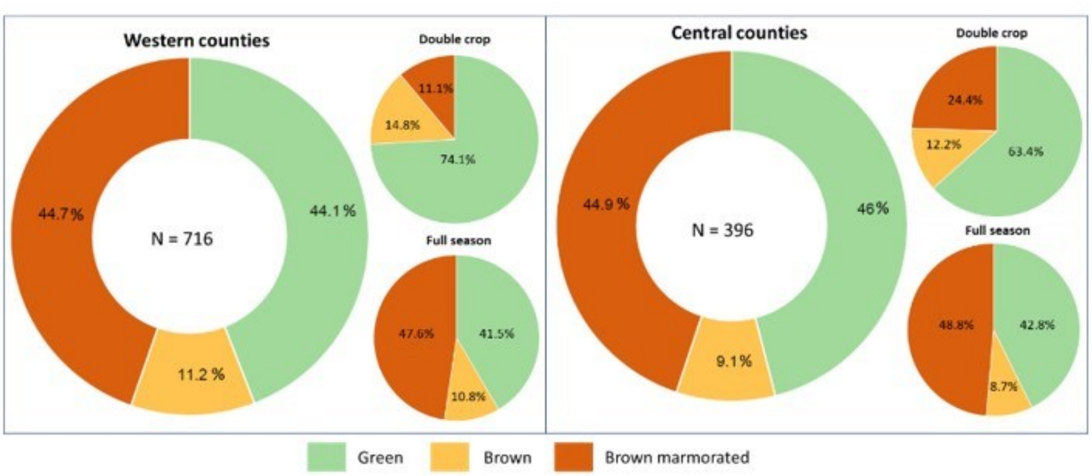

Figure 3. Percentages of the three most common stink bug species in central and western Kentucky (donut charts). The species proportions by planting strategy are displayed in the small pie charts.

The total proportion of stinkbugs did not vary between the western and central regions but between counties. The latter is probably the result of farmer management strategies and periods when we conducted the scouting (prior or post-application of insecticides). The highest number of stink bugs was found in Hancock County (Figure 2).

Discussion

Villanueva (unpublished) did not find the BMSB in many commercial soybean fields of western Kentucky from 2016 to 2019, and Gonzalez (2020) conducting a very intensive scouting for stink bugs in six western Kentucky counties had similar results in 2018 and 2019. Comparing 2020 and 2021, we noticed that BMSB dispersed rapidly. The path of this movement is unknown, it might be from east to west or north to south. The BMSB has been present in Kentucky since 2010; however, in the western region of the state and prior to 2020, findings were sporadic, and in most cases, they were hitchhikers –a well known behavior of this species. Moreover, we confirmed the presence of the BMSB in five new counties in the western region (Carlisle, Ballard, McCracken, and Livingston) and one central (Hancock) Kentucky county. In terms of the geographic spread of BMSB, its proportion is rapidly increasing when compared with 2020 (Figure 4).

The expansion of BMSB may bring new problems for soybean and vegetable growers in western Kentucky. As invasive species, their numbers can increase as natural enemies are not as abundant in Kentucky as in native regions of Asia. In addition, BMSB is a nuisanse for human dwellings, as they move into barns and houses to overwinter, staining walls, producing a foul smell, and/or causing allergies. During the week of October 11 to 15, 2021, one of the authors of this report (Villanueva) was finding between 15 to 32 BMSB on the outdoor side of his screen room. This is significant as he did not observe this from 2016 to 2019.

Figure 4. Changes in the proportion of common stink bugs during 2020 and 2021 in western and central Kentucky. N = total stink bugs collected.

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Villanueva, R.T., and Z. Viloria. 2020. Colonization of western Kentucky by brown marmorated stink bug. In Kentucky Pest News Blog (https://kentuckypestnews.wordpress.com/2020/09/22/colonization-of-western-kentucky-by-brown-marmorated-stink-bug/) (last checked 11/30/21)

Acknowledgement

Funding for this project were provided by the Kentucky Soybean Promotion Board. We would like to thank Christine Bradley and Caleb Whitney for their assistance during the progress of this research.

Evaluation of Soybean Varieties for use in Kentucky

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To maintain soybean as a profitable crop, production efficiency must be increased through higher yields per acre. This can be accomplished in part by using well adapted, superior-yielding varieties. In the past fifteen years Kentucky soybean producers achieved record yields per acre several times: 2001, 2003, 2004, 2006, 2009, and 2013. Primary reasons for this steady yield increase are the continuous improvements of both soybean genetics and agronomic management. An important step in the development of a profitable soybean production system is the selection of a variety that has the potential for maximizing yield in the producer's environment. Public and private varieties were evaluated in performance tests that measure yield as well as other production features such as seed protein and oil composition. Performance tests were located on soybean producers' farms in the major soybean production regions in Kentucky. The varieties' responses to natural insect and disease problems were monitored to determine each variety's reaction to particular pests. The data were subjected to statistical analysis and published in an annual performance test report by the Kentucky Agricultural Experiment Station. The project's ultimate goal is to provide farmers with unbiased information comparing the yield potential of new soybean varieties at multiple locations in Kentucky. The work proposed in this project fulfilled this need.

Major goal of the project

To evaluate the adaptability and productivity of commodity soybean varieties currently available to farmers in Kentucky.

What was accomplished?

The soybean variety performance tests were conducted at 8 test sites in 2021, in the major soybean production regions of Kentucky. Unfortunately data from 2 sites were not suitable for varietal performance analysis due to deer-feeding and herbicide drift damages. The tests were planted following common current agronomic practices for full-season soybean production in Kentucky. 147 varieties from 25 organizations (23 seed companies, 2 public institutions) were entered in the tests. The tests were organized in 5 relative maturity groups (MG): relative maturities 2.0 to 2.9 (3 varieties), 3.0 to 3.9 (40 varieties), 4.0 to 4.5 (44 varieties), 4.6 to 4.9 (53 varieties), and 5.0 to 5.9 (7 varieties). Seed samples were collected at harvest at three test sites, for seed composition analysis. Climactic and pest information over the course of the growing season was also collected.

Yield and seed composition data were statistically analyzed, and the information was released in the yearly progress report (PR). In 2021, the statewide average variety yields ranged from 49.1 bushels/acre for the lowest yielding variety to 89.3 bushels/acre for the highest yielding variety. Maturity group yield averages varied little (groups of 40 varieties or more): the MG 3 yielded an average of 72 bushels/acre, the early MG 4 76.3 bushels/acre, the late MG4 78.9 bushels/acre. 29 MG 3 varieties, 50 early MG 4 varieties yielded 70 or more bushels per acre. With these ranges in yield, farmers benefit from the test results by choosing the varieties and maturity groups best suited for Kentucky. Seed protein and oil percentages expressed at 13% seed moisture were measured by the NIRS technique from whole-seed samples. Protein percentage and oil percentage were stable among maturity groups. Protein percentage ranged from 36.4% for late MG4 to 37.1% for the MG3, and oil percentage ranged from 20.0% for MG 4 Late to 20.7% for MG 3.

The Table below summarizes the data from the past 5 years.

Table 1. Kentucky Soybean Variety Performance Tests, 5 years coverage, Summary Table.

Year	Number of Test Sites	Number of Organizations	Performance (State averages)					
			reMG	2	3	4 Early	4 Late	5
2017	8	26	Number of varieties	3	35	62	68	17
			Yield	56.5	63.1	68.5	68.3	61.9
			Oil	18.7	18.5	18.5	18.3	18.2
			Protein	35.2	34.3	33.7	33.7	33.9
2018	6	26	Number of varieties	4	27	62	68	14
			Yield	41.2	50.7	57.6	57.0	53.0
			Oil	18.9	19.8	19.4	19.4	18.9
			Protein	36.4	35.3	34.9	34.4	35.0
2019	8	24	Number of varieties	3	33	50	58	12
			Yield	58.9	67.6	68	65.3	65.1
			Oil	18.0	19.0	19.2	19.0	18.5
			Protein	35.5	34.7	34.6	34.6	35.2
2020	9	22	Number of varieties	2	38	60	80	16
			Yield	61.2	67.6	69.3	66.2	62.4
			Oil	18.9	19.8	19.5	19.1	18.7
			Protein	34.8	33.8	33.8	33.7	34
2021	6	25	Number of varieties	3	40	44	53	7
			Yield	59.7	72.0	76.3	78.9	74.3
			Oil	20.6	20.7	20.5	20.0	19.6
			Protein	38.0	37.1	36.8	36.4	36.8

Performance is defined as yield and oil & protein seed composition (data are averages for each reMG; yield: bushels/acre; oil & protein as % of seed composition at 13% seed moisture, measured by NIR spectrophotometry)

The project's activities and accomplishments are presented to the Kentucky Soybean Promotion Board. The data are discussed by grain crop extension specialists at county and state extension meetings.

Soybean farmers and soybean breeding organizations (private seed companies and public institutions) benefit from this project by receiving comparative production evaluations of soybean varieties available for sale in Kentucky. Audiences receive the information from the project through presentations, publication of the annual PR, and through the online multi-state database.

Access to online information, printed report, and to the database is completely free of charge (open data).

Products

- Kentucky Soybean Variety Performance Tests Progress Report (PR), Publications of the Kentucky Agricultural Experiment Station:

PR-811 (2011) Venard C. M-P., and Mertz D. R., 2021 Kentucky Soybean Variety Performance Tests

Distribution online and printed resources

The statistical information and the Progress Report are released early online in Excel and pdf formats for easy download from the KY Soybean Variety Performance Trials program website, typically by Mid-November.

1,500 printed copies of the progress report are distributed yearly through the University of Kentucky Cooperative Extension offices in the major soybean productions regions of the state, typically by early December.

- Multistate Database:

Soybean growing regions often cross state lines but variety trials information is typically reported by state. The Multistate Database is the result of a collaborative effort between the University of Tennessee, University of Kentucky, Virginia Tech, North Carolina State, University of Arkansas, and Centrec Consulting Group, LLC. The project is funded by the United Soybean Board. The database allows stakeholders to summarize and filter yield, quality, and phenotypic information based on location characteristics that cross multiple state lines

- Oral presentation – National meeting:

SCC-33 2021 National Variety Testing Meeting (Virtual). Oral presentation: USB Mid-South Soybean Database (Sykes V., Holshouser D., Venard C. M. , Bond R. D., Heiniger R.) *March 2nd, 2021*

College of Agriculture, Food and Environment

2021 Soybean Science Research Report

University of Kentucky

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