



Grantee Information

Project Title: Insect Management in Cover Crop Systems

Institution: University of Illinois Dept. of Crop Sciences

Primary Investigator: Nicholas Seiter

NREC Project # 2019-3-360691-299

Is your project on target from an IMPLEMENTATION standpoint? Yes No

If you answered "no" please explain:

Is your project on target from a BUDGET standpoint? Yes No

If you answered "no" please explain:

Based on what you know today, will you meet the objectives of your project on-time and on-budget? Yes No

If you answered "no" please explain:

Have you encountered any issues related to this project? Yes No

If you answered "yes" please explain:

Sample processing has proceeded slower than expected, in large part due to weather-related delays in planting that dramatically lengthened our sampling period (in some cases to 13 weeks compared with an originally planned 6). In addition, we sampled more fields than we initially planned to. While this will ultimately result in more data than originally anticipated, these data have taken longer to obtain than expected.

Have you reached any conclusions related to this project that you would like to highlight? Yes No

If you answered "yes" please explain:

In the initial year of this planned 3-year study, rye cover crops did not have a dramatic impact on insect pest pressure in corn or soybean. However, we need to repeat the study over multiple seasons to examine this trend under different growing conditions.

Have you completed any outreach activities related this project? Or do you have any activities planned? Yes No

If you answered "yes" please explain and provide details for any upcoming outreach:

We conducted two in-field scouting workshops on insect and slug identification and management in July –one in Effingham County, Illinois on a cooperator’s farm, and one at Ewing, IL in association with a University of Illinois Extension field day. In addition, we presented recommendations on insect management in cover crop systems and preliminary results of our research at two cover crop seminars organized by University of Illinois Extension personnel in Effingham and Jacksonville, IL. A competitive grant from University of Illinois Extension funded these activities, and we have planned and obtained funding for similar activities in 2020. In addition, we plan to produce a fact sheet on identification of pest and beneficial insects found in cover crops, and a video aid to properly scouting cover crops for insects in 2020.

Insect Management in Cover Crop Systems – 2019 Annual Report

2019 was the first year of a planned 3-year study to examine the effects of cover crop production systems on insect management. Our studies included sampling from established, NREC-funded field experiments examining the impacts of cover crops on nutrient runoff, a new experiment to determine the impact of rye termination timing on soybean insect management, and sampling of paired commercial fields to compare insect populations with and without the use of a rye cover crop. Overall, there was not a dramatic trend for increased pest damage in fields following a cover crop. We will repeat these studies in 2020 and 2021 to examine any potential trends over multiple growing seasons and characterize the pest and beneficial insect community inhabiting these cropping systems in Illinois.

Extensive delays in planting characterized the spring of 2019 throughout Illinois, and the fields and plots sampled in our project were no different. We commenced sampling of commercial fields beginning in early April in anticipation of a relatively normal planting season; in most cases, when we finished sampling these fields 3 weeks after planting we had sampled for 3 months instead of the planned 6 weeks. While this resulted in an opportunity to collect more insect data than we originally anticipated, it has also resulted in increased sample processing time to sort and identify these additional specimens. We are on track to have all 2019 samples processed before we begin sampling in 2020. In addition, we do not anticipate any major changes to our budget.

M.S. student L. Brodie Dunn is coordinating many of the sampling activities for this project, with a particular focus on the commercial field-sampling component of Objective 1. Brodie has made good progress toward his degree, and we anticipate his graduation in August 2021. In addition to insects, Brodie has independently monitored birds in fields located in Champaign County to look for any potential effects.

A closely related project (titled Pest and Beneficial Insects in Illinois Cover Crops) funded by University of Illinois Extension has allowed us to expand the number of commercial fields sampled and funded several opportunities for extension and outreach. We conducted two in-field scouting workshops in 2019 where we trained farmers and consultants on proper insect and slug monitoring techniques, in addition to distributing sampling tools. We plan to conduct two more of these workshops in 2020. In addition, we plan to produce a cover crop insect scouting field guide, accompanied by a video scouting aid demonstrating proper scouting techniques.

Objective 1. Assess the impact of cover crop presence on pest and beneficial insect populations at established (3 years of cover crops) field experiments and on commercial fields in Illinois.

In 2019 we sampled insect and slug populations in cover vs. no-cover plots at a Douglas County NREC-funded field experiment conducted by Lowell Gentry and Dan Schaefer (project title, “Nitrogen Management Systems in Tile-Drained Fields: Optimizing Yields while Minimizing Losses”). Specifically, we sampled two treatments: soybean following cereal rye, and soybean following no cover crop. (We originally planned to sample corn following annual rye and corn following no cover, but the annual rye did not survive the bitter cold temperatures of winter 2019). We sampled plots approximately weekly for insects and slugs

from April 9 through July 3 2019. In addition, we sampled damage to the soybean crop on June 27 (growth stage V1) and July 3 (V2). At the final sampling date, no slugs were collected using the shingle traps, and no slug damage was observed in the plots; however, slugs collected in pitfall traps were significantly higher in the cereal rye treatment than in the no-cover treatment ($F = 41.29$, $df = 1, 2$, $P = 0.023$; Table 1). Plant stand was variable among plots, and was not affected by cover treatment ($F = 3.82$, $df = 1, 2$, $P = 0.190$). Over 20% of plants showed some damage from caterpillar pests (feeding across leaf veins), but there was no difference between the cover and no-cover treatments ($F = 2.44$, $df = 1, 2$, $P = 0.259$). However, damage from bean leaf beetle feeding (skeletonized leaves) was higher in the no-cover treatment than in the cereal rye treatment ($F = 361.5$, $df = 1, 2$, $P = 0.003$).

In addition, we sampled insect and slug populations in commercial fields that had a rye cover crop preceding soybean, which were paired with a nearby soybean field that lacked a cover crop. We sampled a total of 44 fields (23 with a cover crop and 21 with no cover crop) beginning on April 10 until July 5, which included a field pair at an NREC-funded rotation project located at Eric Miller's farm in Piatt County. We are still processing many of these samples, and our analysis of these data is ongoing to determine trends based on geography, week of sampling, and other factors. However, preliminary analyses showed no overall difference in slug populations immediately after soybean planting during the week of June 17, 2019 ($F = 3.89$, $df = 1, 7$, $P = 0.089$), but with a slight trend toward higher populations in those fields that followed a rye cover (Table 2). During this same week, there was no difference in stand between cover and no-cover treatments ($F = 0.20$, $df = 1, 9$, $P = 0.664$). (Note that not all fields had been planted at this time). Analysis of the overall community of pest and beneficial insects inhabiting cover crops is also ongoing; to this point, we have identified over 10,000 individual arthropod specimens from over 70 different species in sweep samples, pitfall traps, and yellow sticky cards. This includes 21 different species of beneficial ground beetles, the majority of which are *Poecilus chalcites* and *Pterostichus melanarius* (Figure 1).

We will aim for a similar scope of sampling in 2020, though hopefully with a more typical (and favorable) season for planting soybean than we experienced in 2019. Preliminary analyses indicate that few insect specimens were collected during the early portion of our sampling period; therefore, we plan to delay sampling until average temperatures are sufficient for insect activity. In addition, we will sample fields for a longer time after planting has occurred to further assess damage to the cash crop. We will make improvements to several of our sampling devices based on experience from 2019; in particular, we will use a stronger, PVC base for the pitfall traps to limit trap movement in saturated soils, and will use an improved wire platform for the yellow sticky cards. We will implement these design improvements for the studies described in Objectives 2 and 3 as well.

Objective 2. Determine the effect of cover crop termination timing on pest and beneficial insects in corn at established field sites.

In 2019 we sampled insect and slug populations in experiments evaluating the effects of cereal rye termination timing ahead of corn conducted by Lowell Gentry and Dan Schaefer (project title, "Cereal Rye Ahead of Corn: N Catch and Release). We sampled the experiment located at the Fisher Farm on Monticello Road in Champaign County, Illinois. The treatments were three different cereal rye termination timings

(April 9 [56 days before planting], April 23 [42 days before planting], and May 7 [28 days before planting]) plus a no-cover control. Corn was planted on June 4 2019. The treatments did not affect slug populations measured using shingle traps ($F = 0.61$, $df = 3, 6$, $P = 0.632$) or pitfall traps ($F = 1.57$, $df = 3, 6$, $P = 0.291$). Similarly, cover crop termination treatments did not affect plant stand ($F = 0.19$, $df = 3, 6$, $P = 0.898$). While there was a trend for increased percent damage following a cover compared with the no-cover control (Table 3), overall percent damage was small (less than 5% in all treatments) and this trend was not significant after a single year of data collection ($F = 1.83$, $df = 3, 6$, $P = 0.243$). Insect samples from pitfall traps are still being processed, but will be completed prior to the start of year 2 sampling.

We will repeat this sampling in 2020, with an increased focus on measuring damage to the cash crop.

Objective 3. Determine the effect of cover crop termination timing on pest and beneficial insects in soybean as part of a regional (8 additional locations in 6 additional states) experiment with a common protocol.

We established a new field experiment at the University of Illinois Crop Sciences Research Farm (“South Farms”) in Champaign County, Illinois to examine the effect of cereal rye termination timing on pest management in soybean. This was one of eight locations in a regional trial coordinated by Dr. Justin McMechan, University of Nebraska-Lincoln. Cereal rye in the experimental plots was terminated either 26 days before planting, 17 days before planting, or 2 days after planting, and a no-cover control was also included. Planting occurred on June 2. Termination timing impacted soybean stand on July 3 at growth stage V2 ($F = 4.15$, $df = 3, 9$, $P = 0.042$), with the early-terminated cereal rye treatment having a higher plant stand than the control or the later-terminated treatments (Table 4). However, there was no effect of cereal rye termination timing on insect damage ($F = 0.52$, $df = 3, 9$, $P = 0.681$) or soybean yield ($F = 2.11$, $df = 3, 9$, $P = 0.170$), and overall insect damage was well below levels that would be expected to impact yield. Pitfall trapping revealed 5 distinct species of beneficial ground beetles within the trial, but there were no distinct trends by treatment in this individual site-year. Dr. McMechan will perform analyses across all site years to look for larger trends in insect damage and beneficial insect populations; due to the high variability in insect populations among individual sites, multiple site-years are necessary for this type of work to evaluate trends and develop management recommendations accordingly.

We will repeat this experiment in 2020 using essentially the same methodology; this is part of a regional project that is scheduled to last until 2021.

Table 1. Preliminary insect and slug monitoring results from a NREC-funded cereal rye field experiment at Douglas County. Plots were sampled on July 3, 2019 when soybeans were at the V2 growth stage.

Treatment	Slugs per plot (pitfall method)	Plant stand per 68.2 row-ft	Percent of plants with caterpillar damage	Percent of plants with bean leaf beetle damage
Cereal rye cover	5.7 ± 0.9 a ^a	343.0 ± 1.0 a	20.4 ± 2.7 a	29.5 ± 6.3 b
No cover	0.0 ± 0.0 b	257.7 ± 44.6 a	36.7 ± 10.1 a	41.0 ± 5.9 a

^a Means followed by different letters within a column are different based on the Fisher method of least significant difference ($\alpha = 0.05$)

Table 2. Preliminary slug monitoring and damage evaluations during week 11 (June 17-21, 2019) of sampling from commercial fields throughout central and southern Illinois.

Treatment	Slugs per shingle trap	Plant stand per 1,000 th -acre sample
Rye cover	0.6 ± 0.2 a	160.4 ± 20.8 a
No cover	1.6 × 10 ⁻¹⁶ ± 0.2 a	148.6 ± 15.7 a

Table 3. Preliminary insect and slug monitoring results from a field experiment evaluating the effect of cereal rye termination timing on corn pest management. Plots were sampled on July 16, 2019 (growth stage V8).

Termination timing	Slugs per plot (shingle method)	Slugs per plot (pitfall method)	Plant stand per 35 row-ft	Percent of plants damaged by insects/slugs
No cover	0.3 ± 0.3 a ^a	5.0 ± 1.2 a	71.0 ± 1.5 a	0.5 ± 0.5 a
April 9 (56 days pre-plant)	0.7 ± 0.7 a	3.0 ± 2.1 a	72.0 ± 4.5 a	2.2 ± 1.6 a
April 23 (42 days pre-plant)	0.0 ± 0.0 a	1.3 ± 0.3 a	74.3 ± 3.7 a	4.4 ± 1.7 a
May 7 (28 days pre-plant)	0.7 ± 0.3 a	4.0 ± 2.1 a	71.0 ± 5.2 a	3.2 ± 0.8 a

^a Means followed by different letters within a column are different based on the Fisher method of least significant difference ($\alpha = 0.05$)

Table 4. Preliminary results of year 1 of a field experiment evaluating the effect of cereal rye termination timing on soybean insect pest management. Plots were evaluated on July 3 2019 (growth stage V2).

Termination timing	Plant stand per 17.5 row-ft	Percent of plants damaged	Yield (bu/ac)
No cover (control)	105.8 ± 8.5 b ^a	38.0 ± 11.2 a	47.6 ± 1.1 a
May 7 (26 days pre-plant)	123.8 ± 10.0 a	34.7 ± 5.1 a	48.0 ± 1.7 a
May 16 (17 days pre-plant)	105.0 ± 3.3 b	36.0 ± 9.1 a	43.2 ± 1.8 a
June 4 (2 days after plant)	101.8 ± 7.6 b	25.7 ± 3.4 a	40.3 ± 4.7 a

^a Means followed by different letters within a column are different based on the Fisher method of least significant difference ($\alpha = 0.05$)

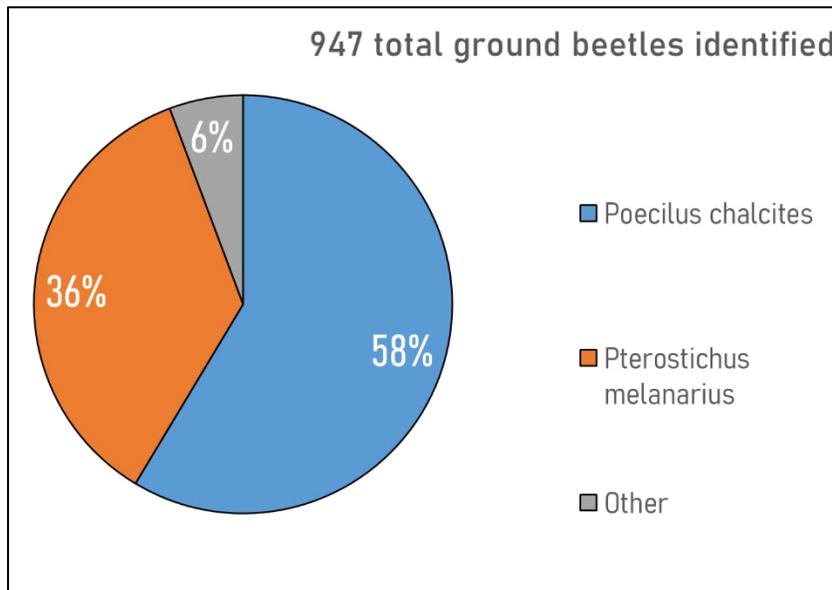


Figure 1. Relative breakdown of ground beetle species identified.