2nd and 3rd Quarter Progress Reports

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**Project Title:** Development of Genetic, Chemical and Population-Based Tactics to Manage Key Kansas Soybean Insect Pests

**Amount of Funding:** $64,260

**Progress Reports:**

June 1-August 31, 2017 (2nd Quarter)

September 1-November 30, 2017 (3rd Quarter)

**Completion Date:** February 28, 2018

**Accomplishments since last report**

**Objective 1: Create soybean plants resistant to soybean stem borer by inserting borer RNA into soybean plants to interfere (RNAi) with genes necessary for borer survival.** Giant ragweed and other weed species are native hosts of *Dectes* stem borers in North America, but borers have adapted to use soybean and cultivated sunflower as hosts. Changes in the number of expressed genes and/or gene expression level may be associated with borer adaptation to feed and survive on soybean. Lina Aguirre, the PhD student conducting this sub-objective, completed a replicated 2017 field cage experiment of sunflower, ragweed and soybean plants infested with soybean stem borer adults. Larvae collected from plants were stored at -80°C, and for each instar, RNA was extracted from three biological replicates per diet source. Each biological replicate contained whole bodies of 6 third-instar or 3 sixth-instar larvae, respectively. PolyA cDNA libraries were sequenced using Illumina paired-end technology RNASeq analysis. This information will be used to identify candidate genes that may be able to be efficiently silenced to kill borer larvae. Transcriptome assembly and differential expression analyses are in progress to describe genes expressed in response to feeding on each of the larval hosts.

**Objective 2. Improve insecticide efficacy by using host plant developmental stages and other environmental cues or conditions to adjust timing of application.** Cooperators were identified early in the growing season and twelve commercial production fields were used in our pest survey study, which started shortly after plants emerged (V3-4) and finished in the late reproductive stages (R6-7); fields were located across a north to south gradient and covered several counties in Kansas. A subset of these fields (8 total), which were located primarily in Clay and Washington Counties, was more extensively surveyed for stinkbugs and other key pests until soybean reached the R6 growth stage. All stink bug specimens were sent to the University of Minnesota as part of a North Central Soybean Research Program project, which aims to develop sampling plans for stinkbugs in soybean using data from across the North Central US. In addition, these data are being used to study how landscape or land use around these fields impacts stink bug populations and/or abundance. For the Kansas study, we swept the interior and perimeter of all 8 fields using sweep nets; a total of 12 sets of 25 sweeps per field was collected and all major pests were identified to species. These data will be used this winter to model the utility of site-specific management strategies (i.e., interior versus perimeter insecticide treatments). In addition, these data add to our sample database and will be used to develop sampling plans for several of the species we observed. In three of these fields we initiated a small-scale (approx. 2 acres) study focused on evaluating the effectiveness of newer insecticide chemistries at different carrier volumes. Fields ranged in size (55-200 acres), variety, and production practices (irrigated vs. dryland, row spacing, plant population, etc.), and a corner of each field was divided into plots (6 rows by 50 feet with a 6-row buffer between plots). The goal of this first year was to develop an experimental design that can be scalable to larger plots and increased replication; these experiments are planned for the 2018 field season. Prior to insecticide treatments, we sampled plots using sweep nets (10 sweeps per plot per location) and individual specimens from the most abundant pests, which in this case green clover worm and thistle caterpillar, were individually weighed. Plots were swept 6 days post application and individuals from the same two species were weighed. Carrier volumes tested were 10 and 20 gallons per acre (GPA) and Prevathon and Steward were the two insecticides applied. We also harvested a 1.5 m section of row from each plot and are currently evaluating individual pods by node for damage. This data will be used to evaluate the level and location of protection these products provide against seed-feeding insects. In addition, these data will be used to correlate changes in plant biomass with changes in herbivore biomass and any impacts on soybean yield. The primary objective of this first year was to ensure a suitable experimental design (e.g., plot spacing, minimized drift, etc.). A graduate student for this project begins in fall of 2018, and his focus will be to model the value of site-specific management strategies and identify ways to optimize insecticide applications for controlling key pests in soybean.

**Objective 3. Expand web pages and other educational materials associated with soybean insect pests**. Co-PI Whitworth and Dr. Holly Schwarting established foliar insecticide trials to test new products and differing rates of application for registered products against green cloverworm, thistle caterpillar and bean leaf beetles. The efficacy of 12 new-chemistry seed treatments for bean leaf beetle control were also tested. Efficacy results and resultant yields are still being determined for these trials. Results of all trials will be posted to the KSU Extension Entomology website and made available to all stakeholders via the KSU entomology website to help Extension personnel and others make the most judicious recommendations relative to pest control and integrated pest management. Insecticide products and links to labels were added to the Chemical Selection tool (<https://www.myfields.info/chemical/selector/search>) on myFields.info web-based platform. Users can select a crop, time of year, and easily find product labels for registered products. Other features that may be of interest can be found at: <https://www.myfields.info/features>.