

**MISSISSIPPI SOYBEAN PROMOTION BOARD**  
**PROJECT 17-2014 (YEAR 3)**  
**2014 Final Report**

**Title:** Threecornered Alfalfa Hopper Management in Soybeans

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**EXECUTIVE SUMMARY**

Objectives of this research were: 1) Refine current TCAH thresholds in soybeans; 2) Estimate sweep net sampling efficiency for TCAH adults in soybeans; and 3) Evaluate efficacy and residual activity of seed treatments and foliar insecticides against TCAH adults and nymphs.

With overall yield not varying significantly with TCAH densities higher than what is observed in a field situation, it is concluded that adult TCAH during reproductive growth stage soybeans has no impact on yield.

The number of TCAH released in threshold trials was equivalent to 5.8 TCAH per sweep. This is approximately three times the current threshold of 2 TCAH per sweep, and still no yield loss was observed.

Based on the results of these trials and the potential of disrupting the natural enemy complex from an insecticide application, there appears to be no justification for having a threshold during soybean reproductive growth stages for TCAH.

The conclusion from this study is that TCAH is not causing economic damage during soybean reproductive growth stages.

Using the last 10 years insecticide costs as a baseline, if all growers in Mississippi were to stop spraying for this pest, growers would reduce insecticide costs by more than \$2.5 million annually.

**BACKGROUND AND OBJECTIVES**

Threecornered alfalfa hopper, *Spissistilus festinus* (Say), is commonly found in soybeans in Mississippi. Threecornered alfalfa hopper (TCAH) often feed around the stem to form a stem girdle. This leads to the accumulation of nutrients above the girdle, providing a nutrient-rich feeding site for TCAH.

Early-season feeding can cause yield losses from lodging and physiological stress because the strength and integrity of the main stem at the girdle is compromised. Little research has been conducted on TCAH damage to reproductive-stage soybean, but most insecticide applications for its control are made during reproductive growth.

During reproductive growth, feeding occurs on lateral branches and leaf petioles, so lodging is not a concern. To address this lack of research, experiments were conducted in 2012, 2013, and

2014 at the R. R. Foil Plant Science Research Center in Starkville, MS and the Delta Research and Extension Center in Stoneville, MS to:

1. Refine current TCAH thresholds in soybeans. This will enable consultants and growers to recommend and apply insecticides only when economically justified.
2. Estimate sweep net sampling efficiency for TCAH adults in soybeans. This information is needed to be able to translate sweep net catches into estimates of overall pest density and to convert threshold research results (Obj. 1) into sweep net equivalents.
3. Evaluate efficacy and residual activity of seed treatments and foliar insecticides against TCAH adults and nymphs. This will improve grower insecticide product selection.

## **PROGRESS**

**Objective 1.** Experiments were performed at the R. R. Foil Plant Science Research Center in Starkville, MS and the Delta Research and Extension Center in Stoneville, MS during 2012, 2013 and 2014 with common MG IV and V varieties planted during June and July of each year. Soybeans were planted on 38-40-inch-wide rows with plant density of 8 plants per row foot. Field cages with dimensions of 6 ft x 6 ft x 6 ft were set up during the R3 growth stage on two rows of soybeans. Four to eight cages were used at a time, depending on the abundance of TCAH populations.

Half of the cages were infested with 720 adults per cage (60/row ft) collected from nearby soybean fields, while the other half of the cages were left uninfested. Cages were infested during the R4 growth stage. After 14 days, the cages were removed and the plots were sprayed with insecticide to end the infestation. Three days after the insecticide application, 5 plants were removed from each cage and the number of girdles on the main stem, lateral branches, leaf petiole, peduncle, and pod was recorded. Plots were harvested at maturity using a plot combine.

Infestations of TCAH during reproductive growth significantly increased the number of girdles observed in only 3 of 8 trials (Fig 1.). The reasons for this are unclear. While some mortality occurred, TCAH could be readily observed in infested cages throughout the trial. It is possible that adults girdle plants only under certain conditions, but the conditions that cause girdling are unknown. Adults can feed without creating girdles, so the absence of girdles does not mean that plant injury did not occur.

Seed yield did not vary at any location (Fig. 2). When pooled over all locations, the number of girdles in infested cages was significantly higher than in uninfested cages ( $F= 10.74$ ;  $df= 1, 45.5$ ;  $P= 0.002$ ), but there was still no significant difference in yield ( $F= 0.56$ ;  $df= 1, 48.04$ ;  $P= 0.457$ ) from TCAH feeding. Even when pooling just over the three locations that had significant girdling, there was no yield response ( $F= 1.15$ ;  $df= 1, 21$ ;  $P= 0.295$ ). With overall yield not varying significantly with TCAH densities higher than what is observed in a field situation, it can be concluded that adult TCAH during reproductive growth stage soybeans has no impact on yield.

This trial was not able to examine the impact of feeding by nymphs, which are known to feed lower on the plant and are more prone than adults to creating girdles. However, large nymph

populations are rarely observed in soybean, and an efficient method to sample nymphs is unknown. Given that nymphs feed in the same manner as adults, although lower on the plant, it is unlikely that nymphs cause substantially more plant injury than adults.

**Objective 2.** To estimate sweep net efficiency, experiments were performed at the R. R. Foil Plant Science Research Center in Starkville, MS during 2012, 2013 and 2014. Soybeans were planted as described under objective 1. Cages (20 ft x 20 ft x 6 ft) were set up during the R3 growth stage, and covered six rows of soybeans.

Treatments consisted of four TCAH densities (mostly 0, 300, 600, or 900 adults/cage) being released inside the field cages during reproductive growth stages R4-R6. One day after infestation, a 20-sweep sample was taken from each cage. After counting, the insects were re-released in the cage. Additional samples were taken from these same cages on each of the next 3 days. After 4 samples were collected, the cages were moved and the trial was initiated again in another location.

Sweep net sampling is an effective tool for estimating TCAH densities. The regression of released adults with captured adults in a sweep net was significant ( $F=140.64$ ;  $df=1, 44.4$ ;  $P<0.0001$ ). The number of TCAH collected increased by 1.9 per 20 sweeps for each additional TCAH released per row ft (Fig 3). Based on this recapture rate, the number of TCAH released in the threshold trials was equivalent to 5.8 TCAH per sweep. This is approximately three times the current threshold of 2 TCAH per sweep, and still no yield loss was observed. Based on the results of these trials and the potential of disrupting the natural enemy complex from an insecticide application, there does not appear to be any justification for having a threshold during soybean reproductive growth stages for TCAH.

**Objective 3.** No useable data were collected on this objective due to a lack of early-season presence of TCAH.

## **IMPACT AND BENEFITS TO MISSISSIPPI SOYBEAN PRODUCERS**

Insecticides are annually applied to control TCAH in reproductive stage soybeans. Based on published soybean insect losses, foliar insecticide costs for TCAH in Mississippi have averaged \$1.21/acre over the last 10 years, ranging from \$0.10 in 2014 to \$2.86 in 2009. Using the last 10 years insecticide costs as a baseline, if all growers in Mississippi were to stop spraying for this pest, growers would reduce insecticide costs by more than \$2.5 million annually.

This message has already been received by many growers as the number of applications targeting this pest in Mississippi has been reduced by about 50% each year since 2009, when 650,000 acres were sprayed for TCAH. During 2014, only 25,000 acres were sprayed for this pest. Mississippi has produced record yields during this period, further supporting our conclusions that this pest is not causing economic damage during soybean reproductive growth stages.

## **END PRODUCTS**

This research was the primary focus for Jeff Ramsey, an M.S. student in entomology at Mississippi State University. His thesis can be accessed [here](#). It is also expected that this

research will be published in a scientific journal. Results of this study will be used when revising the TCAH threshold in the Mississippi Insect Control Guide for Agronomic Crops next year.

Presentations given on this research over the life of this grant were:

Ramsey, J., A. Catchot, F. Musser, J. Gore, D. Cook and T. Irby. Evaluating threecornered alfalfa hopper (*Spissistilus festinus*) as a pest in Mississippi soybeans. Future of Agriculture Graduate Student Competition, Mississippi State, MS, Feb. 5, 2015.

Ramsey, J., A. Catchot, F. Musser, D. Cook, and J. Gore. Evaluating threecornered alfalfa hopper (*Spissistilus festinus*) as a pest in Mississippi soybeans. Entomol. Soc. Amer. Annual meeting, Portland, OR, Nov. 17, 2014.

Ramsey, J., A. Catchot, F. Musser, D. Cook, J. Gore and T. Irby. Evaluating threecornered alfalfa hopper, *Spissistilus festinus*, as a pest in Mississippi soybeans. MS Entomol. Assn. annual meeting, Mississippi State, MS, Oct. 21, 2014.

Musser, F. Crop pest threshold changes for 2014. Annual Conference of the MS Agricultural Consultants Association, Mississippi State, MS, Feb. 4, 2014.

Musser, F. Insect threshold changes in MS row crops. Row Crop Short Course. Miss. State, MS, Dec. 2, 2013.

Ramsey, J., A. Catchot, F. Musser, J. Gore and D. Cook. Pest status of threecornered alfalfa hoppers in Mississippi soybean. Entomol. Soc. of America annual meeting, Austin, TX, Nov. 11, 2013.

Ramsey, J., A. Catchot, D. Cook, J. Gore and F. Musser. The pest status of threecornered alfalfa hopper in Mississippi soybean. MS Entomol. Assn. annual meeting, Mississippi State, MS, Oct. 22, 2013.

Musser, F. R., I. Pulakkatu-thodi, A. L. Catchot, J. Gore and D. Cook. Pest status of threecornered alfalfa hopper (*Spissistilus festinus*) in reproductive stage soybeans. Entomol. Soc. of America annual meeting, Knoxville, TN, Nov. 11, 2012.

Musser, F., I. Pulakkatu-thodi, and J. Gore. Threecornered alfalfa hoppers in soybeans. MEA, MWSS and MAPPAN Joint Meeting. Mississippi State, MS, Oct. 22, 2012.

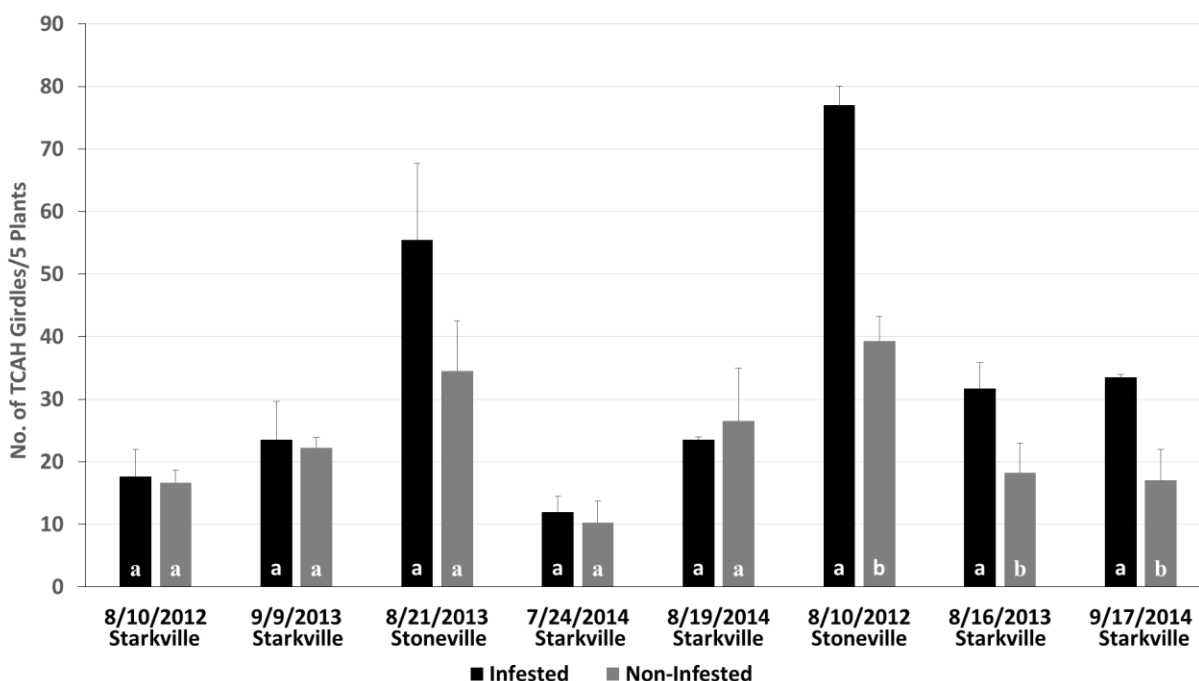


Fig. 1. Mean number of girdles  $\pm$  SEM/5 plants on caged soybeans either infested with 60 TCAH adults/row ft or uninfested for 2 weeks during reproductive growth (Starkville and Stoneville, MS).

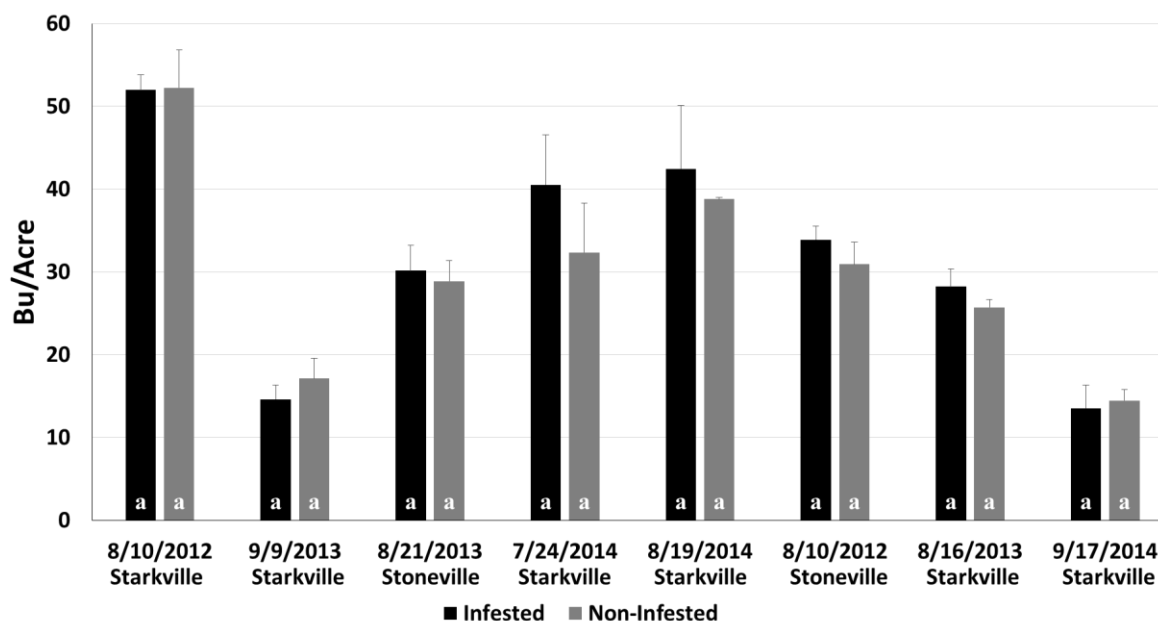


Fig. 2. Mean yield  $\pm$  SEM (kg/ha) on caged soybeans either infested with 60 TCAH adults/row ft or uninfested for 2 weeks during reproductive growth (Starkville and Stoneville, MS).

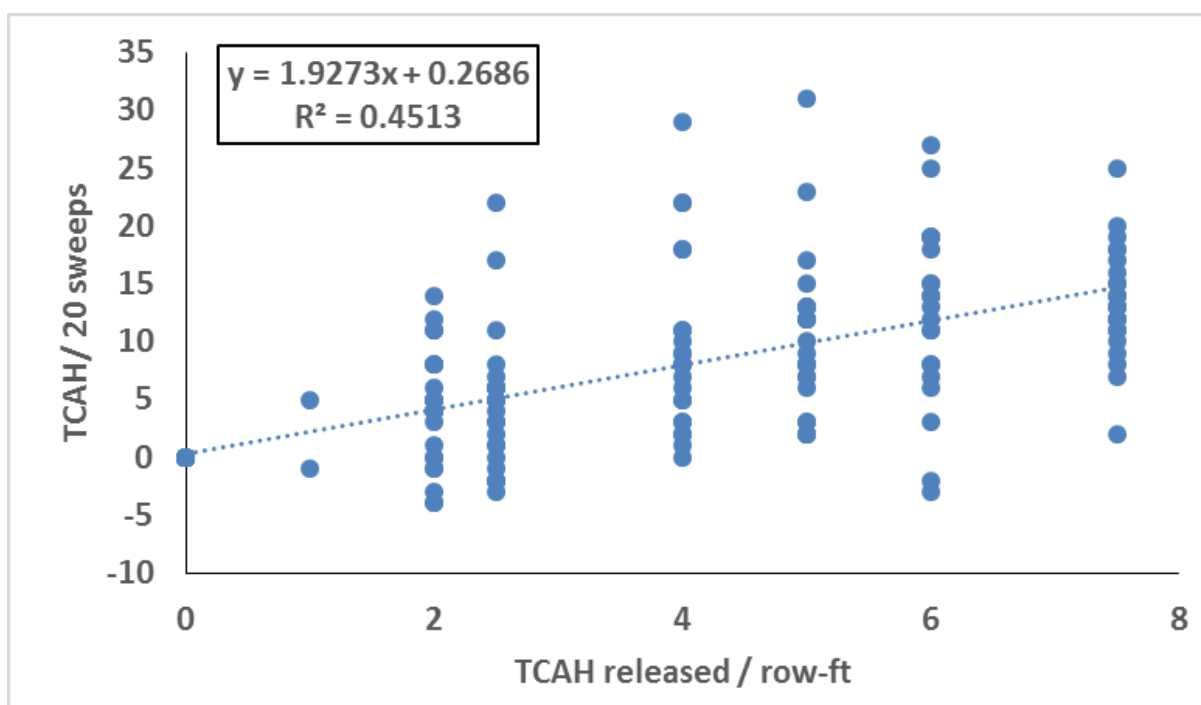


Fig. 3. Regression of the number of TCAH caught per 20 sweeps with the number of TCAH released (Starkville, MS 2012, 2013, 2014). Actual data corrected for the number of naturally occurring TCAH in the field as estimated by the number caught in cages where no insects were released.