REFINEMENT AND VALIDATION OF SOYBEAN LOOPER (*CHRYSODEIXIS INCLUDENS*) THRESHOLDS IN MISSISSIPPI SOYBEANS

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Abstract

Studies were performed to refine the soybean looper larval threshold for reproductive stage soybeans in Mississippi. The current threshold recommendation for reproductive soybeans is 19 soybean looper larvae 0.5 in. or larger found per 25 sweeps. This threshold was developed many years ago under very different production systems, additionally, the defoliation threshold for reproductive stage soybeans was recently determined to be 20%. Therefore, studies were conducted to evaluate and refine the current threshold and sampling methods in Mississippi's soybean production system. Sweep net and drop cloth methods were taken across various conditions and used to develop an equivalency that was to be used in threshold research. Additional tests were conducted to determine the relationship between soybean looper larvae densities and the defoliation. Overall, it was determined that for every larvae e 0.5 in. found in a sweep net, 0.8 larvae of the same size were found on a drop cloth, and 16 larvae per 25 sweeps (total larvae) or 12 larvae (e 0.5 in.) per 25 sweeps resulted in 20% defoliation.

Introduction

Soybean looper is a migratory defoliator that can cause significant damage in mid to late season soybean crops. Soybean looper populations have limited overwintering sites in the United States, but as temperatures increase the overwintering populations in southern Texas, Louisiana, and Florida in addition to those from Mexico, Central and South America, and the Caribbean islands that migrate north. (Funderburk et. al. 1999). Soybean defoliation during the reproductive stages can affect yield through reduced light interception that results in decreased photosynthesis, loss of leaf storage, and shortening of the pod filling period of reproduction (Board et al. 1997). Previous research at Mississippi State University determined that the defoliation threshold for reproductive stage soybeans is 20%. (Owen et al. 2012). The current threshold for soybean looper larvae infesting reproductive stage soybeans is 4 or more larvae e 0.5 in. per row ft. using drop cloth sampling or 19 larvae e 0.5 per 25 sweeps using sweep net sampling. (Catchot et al. 2018). The relationship between these insect densities and defoliation has not been fully investigated.

Materials and Methods

Studies were conducted during 2017 and 2018 in Mississippi to refine and validate the current soybean looper threshold in reproductive stage soybeans. The first objective of this study was to examine the relationship between insect densities using the drop cloth and sweep net sampling methods. Commercial fields throughout Mississippi with established looper populations were sampled using both methods. Large groups of individuals sampled random locations in each of these fields 5 times with a standard drop cloth (5 row feet per drop) and with 5 sets of 25 sweeps. Each sample was recorded and classified as either <3rd, 3rd instar, 4th instar, or 5th instar. In comparing the drop cloth samples to those taken with a sweep net, each drop cloth sample was paired with a sweep net sample performed by the same individual. These pairs of samples were treated as subsamples. Data for total numbers of soybean looper larvae, larvae <3rd instar, and larvae e 3rd instar captured using sweep net and drop cloth sampling methods were subjected to regression analysis using PROC GLIMMIX in SAS. The NOINT option in SAS was used to set the intercept of the regression line to zero.

Studies to examine the relationship between soybean looper density levels of defoliation were also conducted during 2017 and 2018. The first method of this study was to sample natural infestations of soybean loopers. Randomized complete block tests with 7 treatments and 4 replications were each year and allowed to become infested naturally by soybean loopers. The trials were treated with acephate to reduce densities of predators and parasitoids. One plot per replication was treated with chlorantraniliprole (Prevathon 0.43SC, 20 oz. form. / acre) at least weekly at the first

observation of soybean looper larvae to minimize defoliation as much as possible. Sampling was initiated at ca. 3 days after the first observation of soybean looper infestations, and plots were sampled weekly while larvae were present, using sweep net sampling (25 sweeps/plot). Larval size was visually estimated (<3rd, 3rd, 4th, or 5th instar) and data were recorded based on larval size. On each sampling date, 5 random plants from each plot were removed and area of all of the leaves on each plant was determined using a Li-Cor 3100C leaf area meter. An estimate of percent defoliation for each of the non-treated plots in a replication was calculated using the formula ((1-(leaf area of non-treated plot/leaf area of treated plot)) *100). Data for percent defoliation and numbers of looper larvae per 25 sweeps were subjected to regression analysis using PROC GLIMMIX in SAS.

Results

A significant relationship between total numbers of soybean looper larva captured using sweep net sampling and drop cloth sampling was observed (Figure 1). For every soybean looper larva captured with a sweep net (25 sweeps), 0.7 larvae were caught using a drop cloth (5 row feet). Currently the threshold in Mississippi only considers larvae e0.5 in., therefore data were partitioned into categories of larvae <0.5 in. which was deemed to be 3rd instar, ande0.5 in. which were deemed to be those 3rd through 5th instar. A significant relationship between soybean looper larva <3rd instar captured using sweep net sampling and drop cloth sampling was observed (Figure 2). For every soybean looper larva <3rd instar captured with a sweep net (25 sweeps), 0.4 larvae were caught using a drop cloth (5 row feet). A significant relationship between soybean looper larva e3rd instar captured using sweep net sampling and drop cloth sampling was observed (Figure 3). For every soybean looper larva e3rd instar captured with a sweep net (25 sweeps), 0.8 larvae were caught using a drop cloth (5 row feet).

A significant relationship was observed between total soybean looper densities and percent defoliation (Figure 4.) For every increase of 1 soybean looper larvae per 25 sweeps defoliation increased 0.54%. When only considering larvae e3rd instar (e0.5 in.,), a significant relationship between larval densities and percent defoliation was also observed (Figure 5). With every increase of 1 larva per 25 sweeps, percent defoliation increased by 0.62%. Based on the regression equation 12 larvae per 25 sweeps should result 20% defoliation, which is lower than the current threshold of 19. However, these data are preliminary and further investigation is needed.

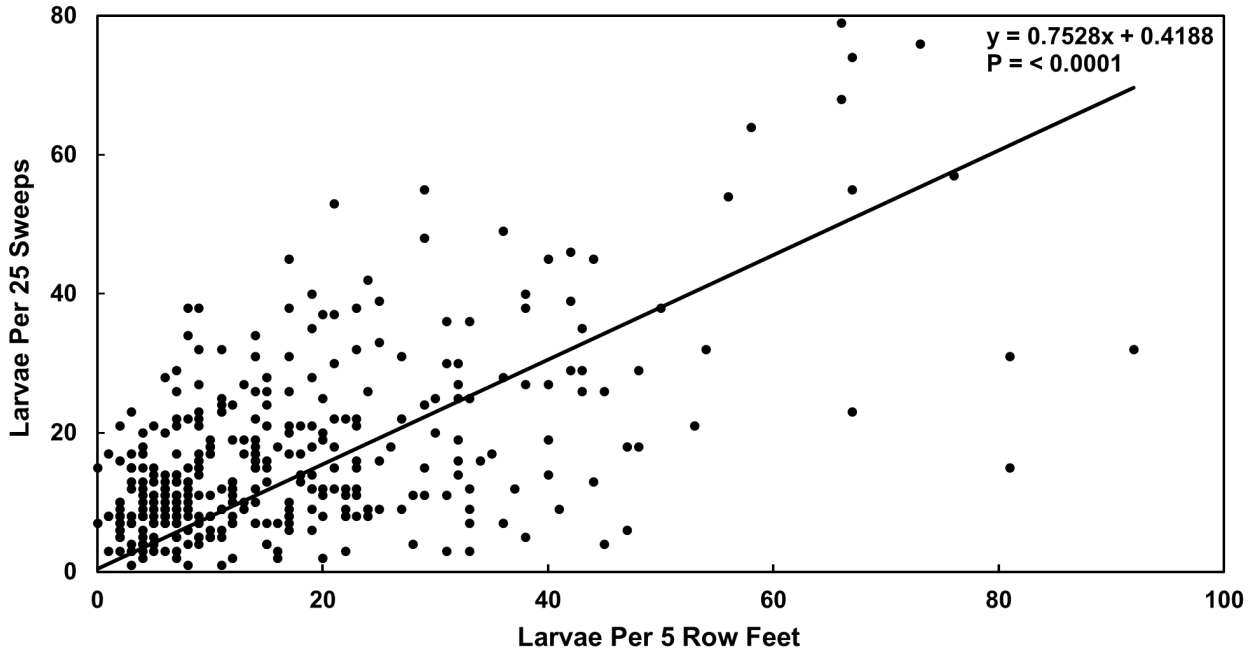

Figure 1. Comparison of multiple sampling methods for total soybean looper larvae.

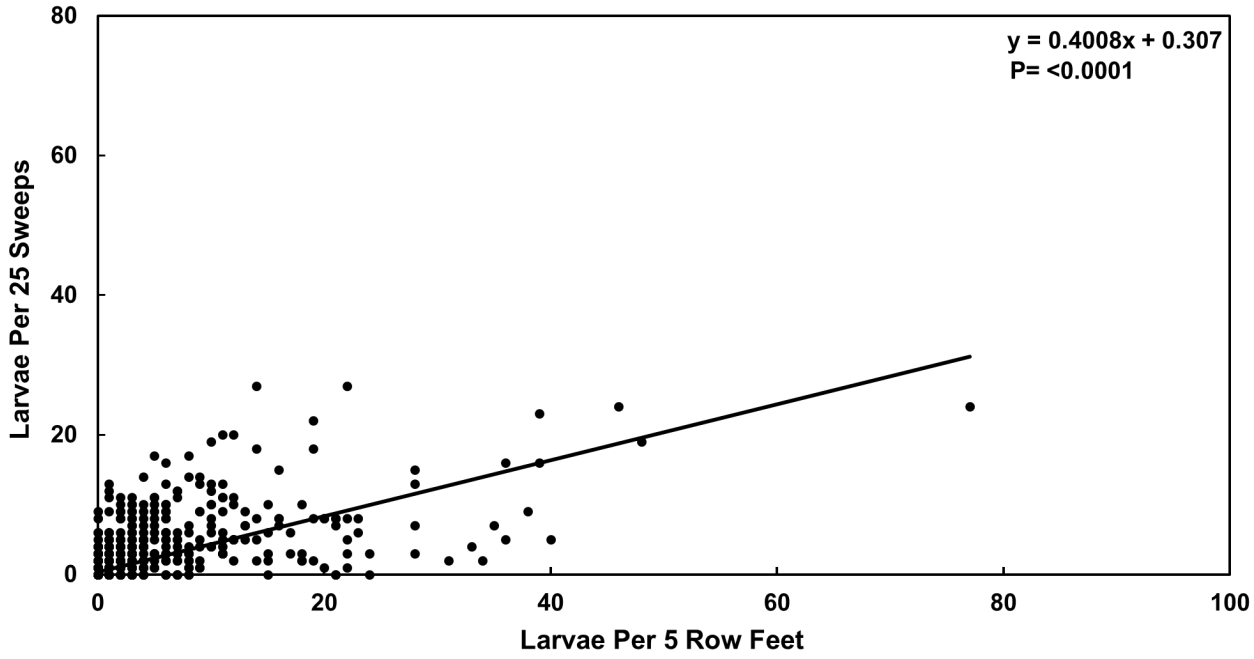

Figure 2. Comparison of multiple sampling methods for soybean looper larvae <0.5 in.

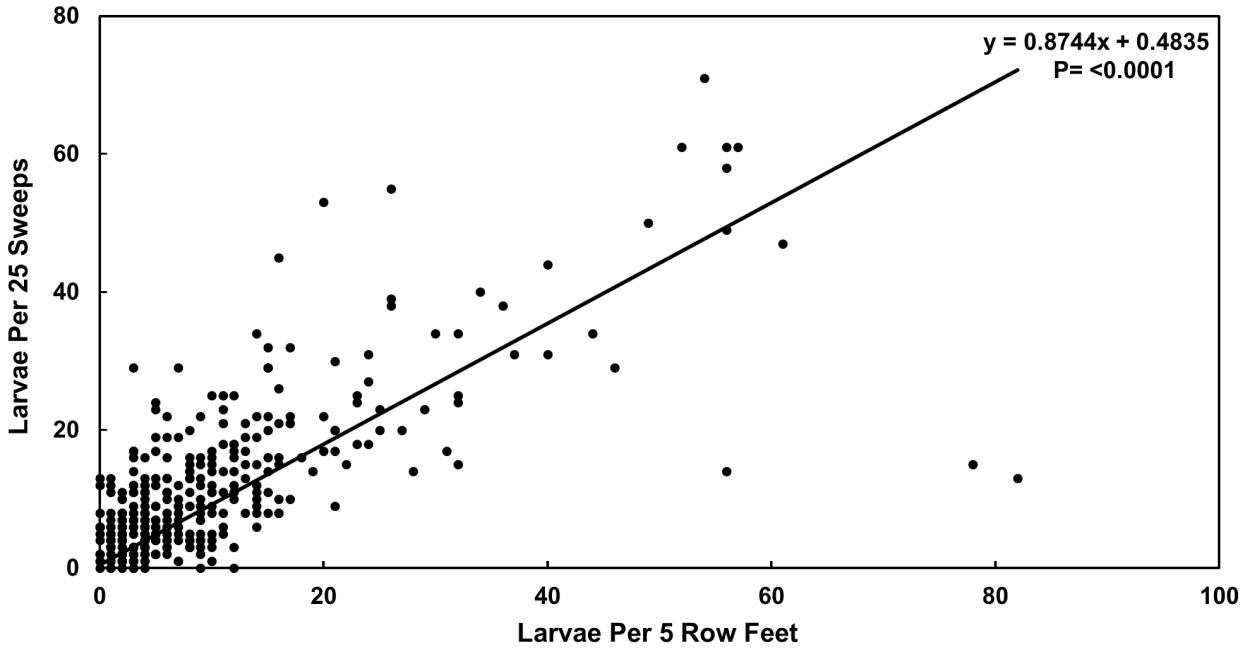

Figure 3. Comparison of multiple sampling methods for soybean looper larvae e 0.5 in.

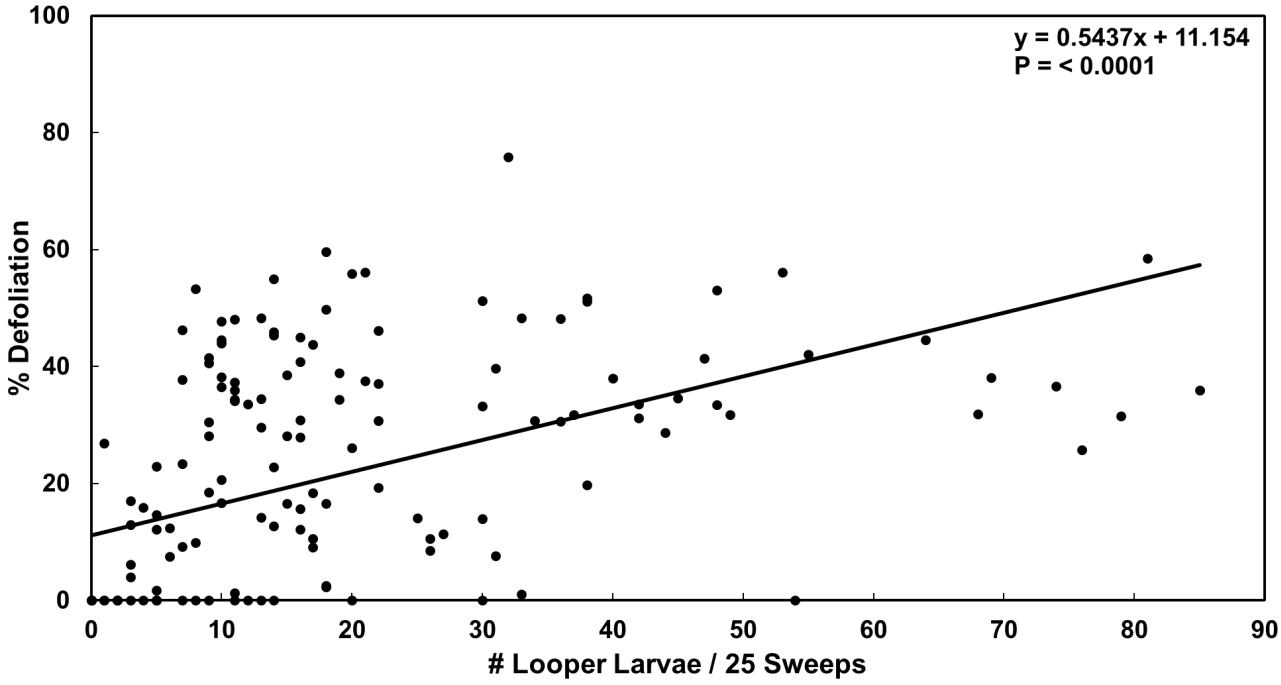

Figure 4. Relationship between densities of total soybean looper larvae and percent defoliation.

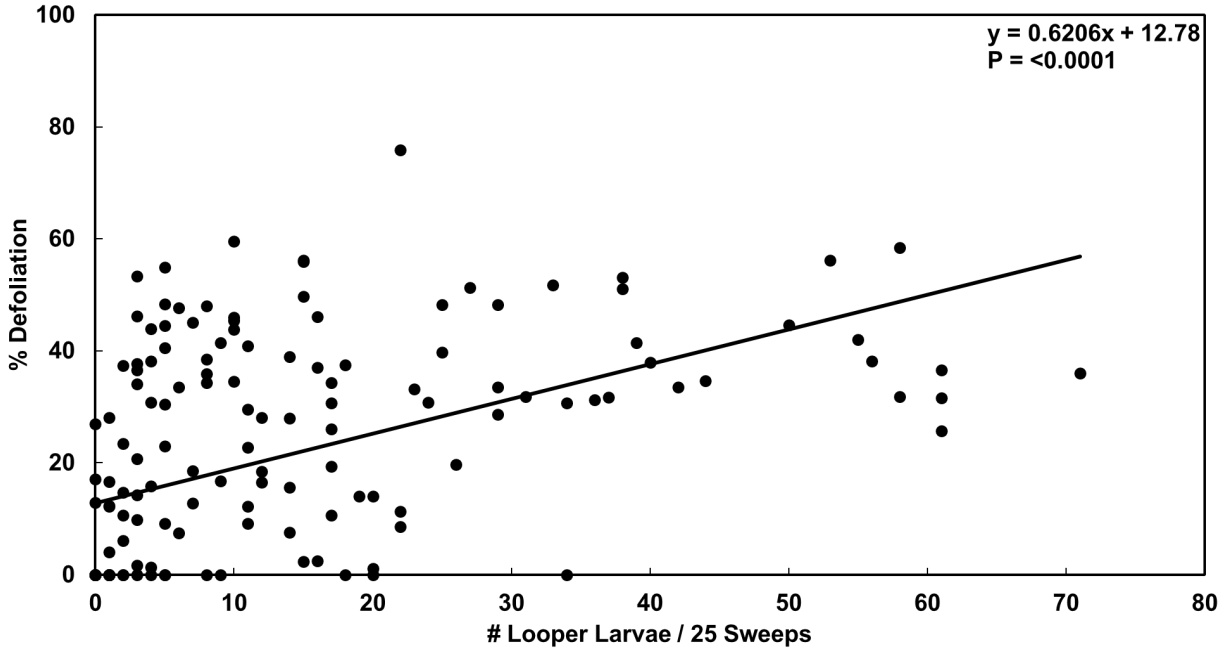

Figure 5. Relationship between densities of soybean looper larvae e0.5 in. and percent defoliation.

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References

Board, J. E., A. T. Wier, and D. J. Boethel. 1997. Critical Light Interception during Seed Filling for Insecticide Application and Optimum Soybean Grain Yield. Agronomy J 89: 369-374.

Catchot A. L, C. Allen, J. Bibb, D. Cook, W. Crow, J. Dean, D. Fleming, J. Gore, B. Layton, N. Little, J. MacGown, F. Musser, S. Winter, D. Dodds, T. Irby, E. Larson, and S. Meyers. 2018. 2018 Insect Control Guide for Agronomic Crops. Mississippi State University Extension.

Funderburk, J., R. McPherson, and D. Buntin. 1999. Soybean Insect Management, pp. 273-290. In L.G. Heatherly and H.F. Hodges (eds.), Soybean Production in the Midsouth. CRC Press LLC, Boca Raton, Florida.

Owen, L. N. 2012. Effects of Defoliation in Soybeans and Susceptibility of Soybean Loopers to reduced Risk Insecticides. Ph.D. dissertation, Mississippi State University, Mississippi State, MS.