DEFOLIATING CATERPILLAR PEST IN MISSISSIPPI PEANUT

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Abstract

A complex of defoliating caterpillars commonly infests peanut, *Arachis hypogaea* L., in Mississippi and often requires management with foliar insecticide applications. To better understand the effects of defoliation on Mississippi peanut yields, experiments were conducted in Stoneville at the Delta Research and Extension Center and Starkville at the R. R. Foil Research Facility at several important peanut growth stages. To achieve defoliation in the early growth stage experiments, manual hand defoliation was necessary. Late growth stage experiments were infested with corn earworm, *Helicoverpa zea* (Boddie) and fall armyworm, *Spodoptera frujiperda* (J. E. Smith). A maximum of 50% defoliation was achieved in these infestation experiments. A significant relationship between defoliation and peanut yield was observed for both the early season and mid-late-season experiments. Based on the regression analyses, 5.66 lbs and 15.3 lbs of peanuts were lost for every 1% defoliation. These results will be important for improving current IPM strategies for defoliating caterpillar pests of peanut.

Introduction

Originating from South Africa, *Arachis hypogaeae* L., commonly known at the peanut or ground nut, is a legume grown in subtropical and tropical areas (Hammons 1982). Globally, seasonal rain fed areas are where peanut production occurs (Nageswara Rao et al. 2001). Peanut are used in the food industry as supplements, oils, and edible seeds. (Mcwhatters and Cherry 1982, Stalker 1997, Nageswara Rao et al. 2001). In the United States, peanut are sold for human consumption (Stalker 1997). Not only is the seed important for consumption but meal for animal consumption is made from the foliage by extracting the oils (Stalker 1997). Harvested acres of peanuts in the United States rose from roughly 1 million acres in 2013 to 1.7 million acres in 2017 and remained comparable for 2018 (NASS 2018). Although national harvested area remained relatively stable the past couple of years, the Mississippi harvested acreage decreased from roughly 42 thousand acres to 26 thousand acres likely due to high input costs, low commodity prices, and unfavorable early season weather conditions. To continue to grow a profitable peanut crop, evaluating and refining action thresholds and improving decision process for grower will be critical to ensure profitability and ultimately sustainability. Currently, the only Mississippi threshold recommend is 4 caterpillars per row foot early season, and 8 caterpillars per row foot late season and is similar for all species. Defining alternate thresholds, such as a sweep net and a defoliation threshold, would be beneficial to farmers and consultants to minimize input costs and improve accuracy and timely insecticide applications.

Materials and Methods

Correlation of sweep net and drop sampling methods

Four regions were established with multiple locations within each region to ensure a suitable distribution. Two fields at each location were sampled every two weeks using two different methods and pests were recorded. The sampling methods used included drop cloth and sweep net samples. A total of 100 sweeps and 4 drops were taken at each sub-location. The nine species recorded include bollworm, *Helicoverpa zea* (Boddie); fall armyworm, *Spodoptera frujiperda* (J. E. Smith); yellowstriped armyworm, *Spodoptera ornithogalli* (Guenée); cabbage looper, *Trichoplusia ni* (Hübner); southern armyworm, *Spodoptera eridania* (Stoll); beet armyworm, *Spodoptera exigua* (Hübner); green cloverworm, *Hypena scabra* (Fabricius); velvetbean caterpillar, *Anticarsia gemmatalis* (Hübner); and granulate cutworm, *Feltia subterranean* (Fabricius).

Evaluating losses associated with insect defoliation to create a defoliation threshold

Tests were located at two locations, Stoneville (DREC), MS and Starkville (R.R. Foil Research and Demonstration Center), MS in 2017 and 2018. Georgia 06-G were planted on 38" beds at 6 seed per foot. Plots were 10 feet long and 4 rows wide. Fall armyworm larvae were released three times a week for 5 weeks at three timings corresponding with important growth stages: 40, 80, and 100 days after emergence. Target larval growth stage was third instar to insure maximum feeding and damage to the plants. This was equal to 12 larvae per row foot per week of infesting. Weekly defoliation ratings were taken by assessing "fresh" feeding (feeding on tender upper growth). These ratings (incremental defoliation levels) were used to accumulate a season long defoliation percentage.

Results and Discussion

Correlation of sweep net and drop sampling methods

In a 2017 survey, method was an important factor (Figure 1). When using the sweep net method, pest such as bollworm that feed in the upper canopy were collected at greater densities than when using the drop cloth method (Figure 2). When using the drop cloth method, pests such as granulate cutworm that feed lower in the canopy were collected at greater densities than when using the sweep net method (Figure 3). By performing sweep net and drop cloth sampling methods at each location, correlations were developed to calibrate the threshold for the sweep net sampling method (Figure 4).

Evaluating losses associated with insect defoliation to create a defoliation threshold

Previous research by Abbott et al. (2019) did not observe a relationship between canopy defoliation and peanut yields at 80 days after emergence. In contrast, peanut yields were significantly reduced by 13.61 lbs. per acre for every 1 percent of defoliation at 80 days after emergence (Figure 5). This research was a single hand defoliation event which may over exaggerate yield losses associated with defoliation. Yield losses associated with incremental defoliations caused by caterpillar infestations were significantly reduced by 5.66 lbs. per acre for every 1 percent of defoliation 30 days after emergence (Figure 6) and significantly reduced by 15.3 lbs. per acre for every 1 percent of defoliation from 60-100 days after emergence (Figure 7). These preliminary results demonstrate the impact of insect defoliation in peanuts on final yields. More research is needed before actual economic injury levels can be established.

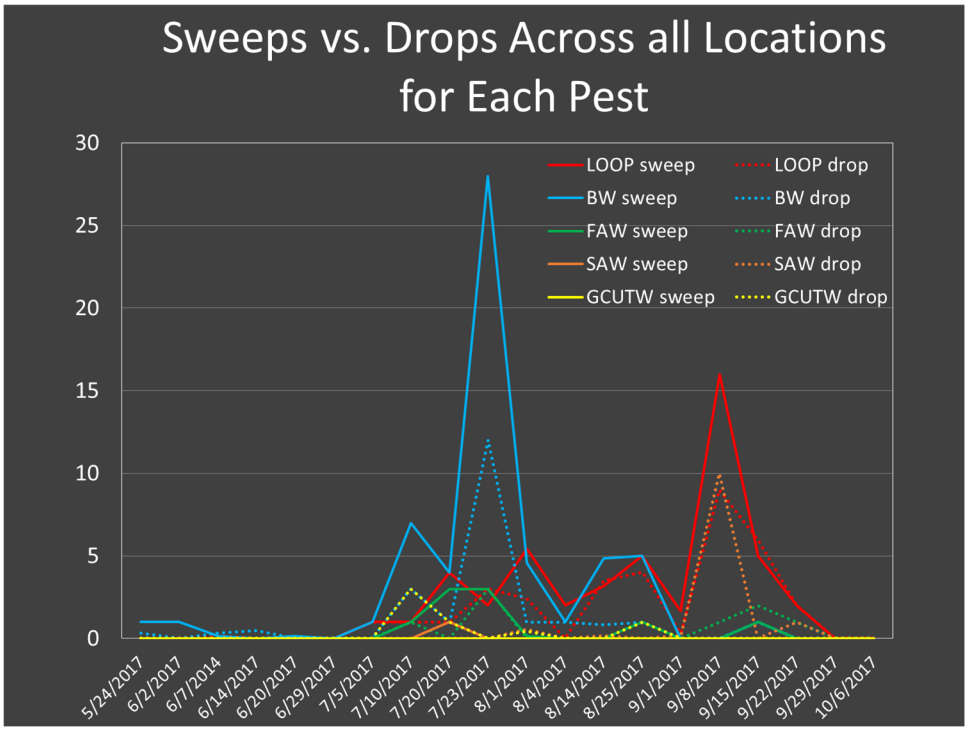

Figure 1. Sweep net method verses drop cloth method across all location for each pest.

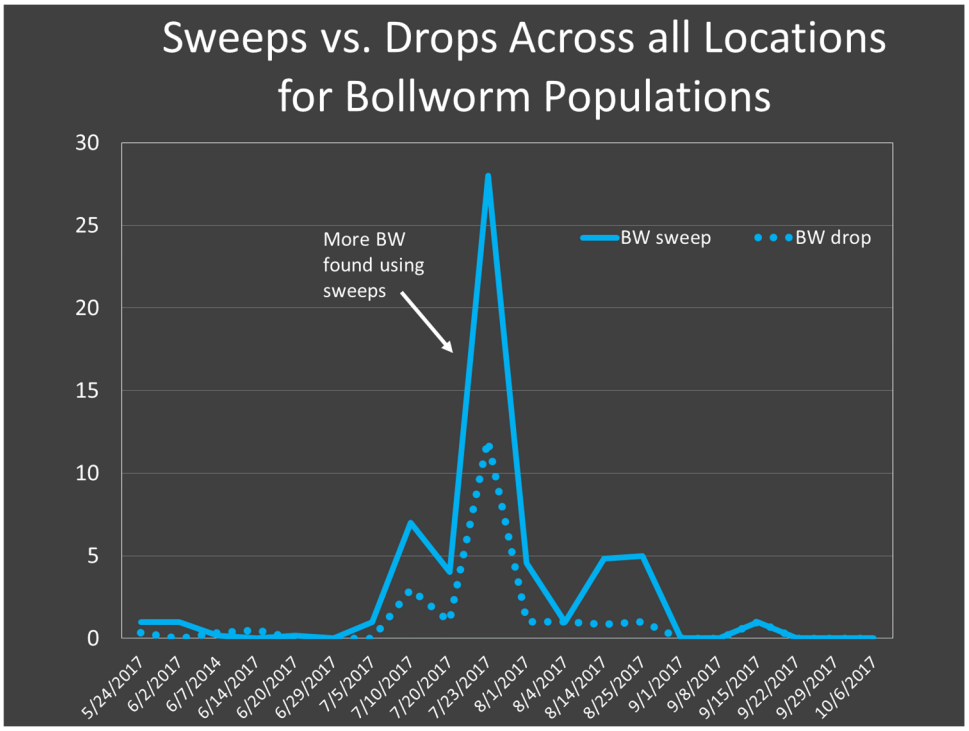

Figure 2. Comparing bollworm populations using sweep net sampling method and drop sampling method.

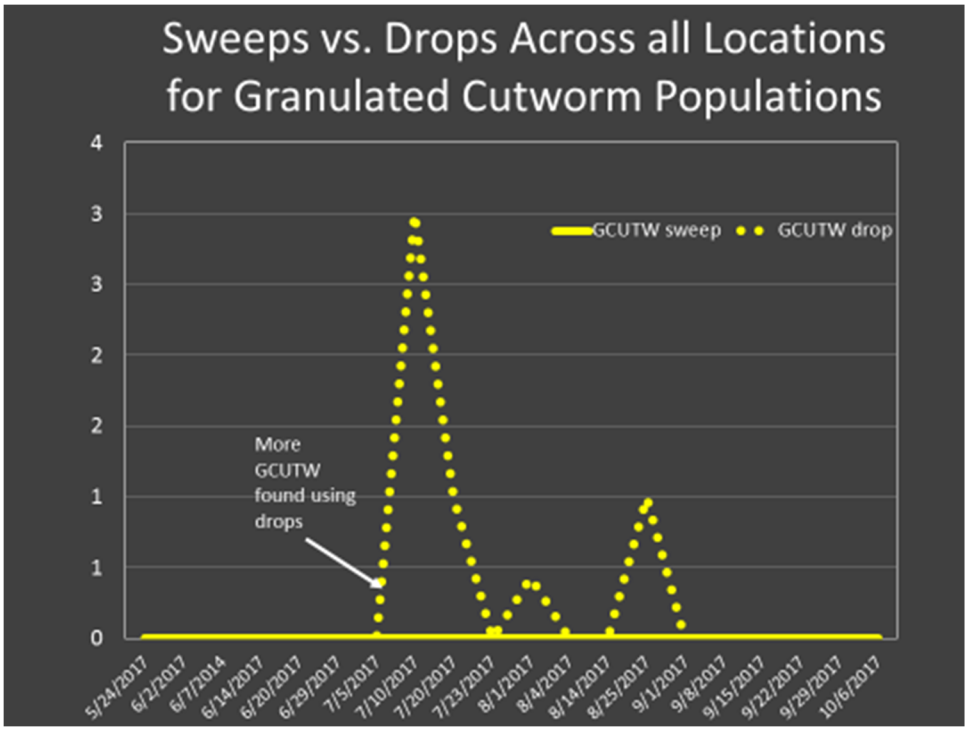

Figure 3. Comparing granulated cutworm populations using sweep net sampling method and drop sampling method.

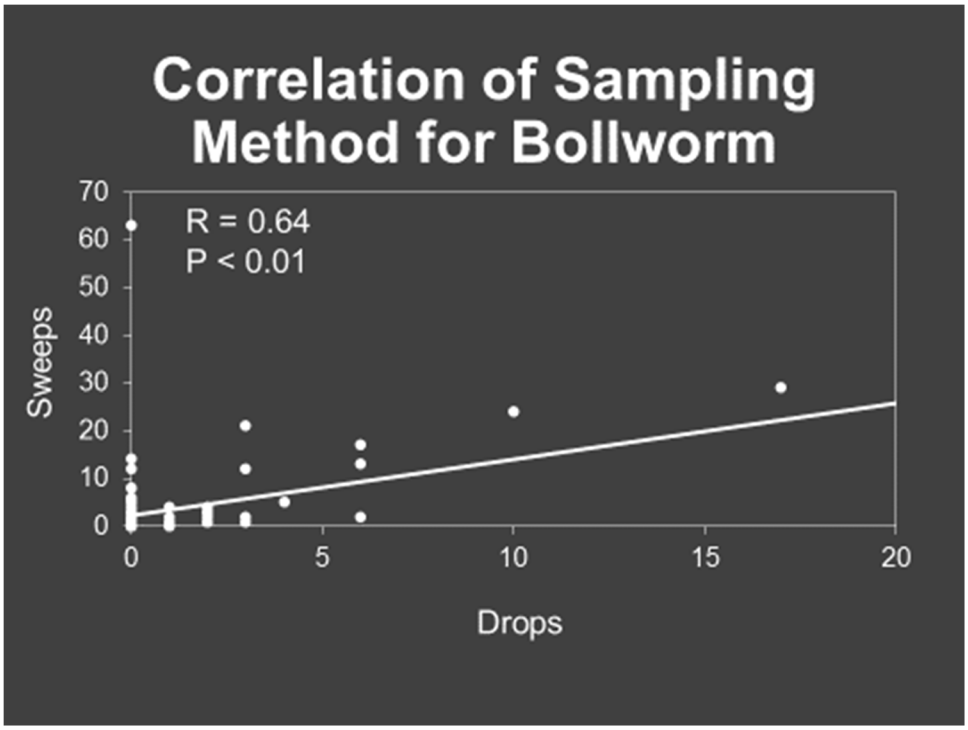

Figure 4. Correlation of sweep net sampling method to drop sampling method of bollworm.

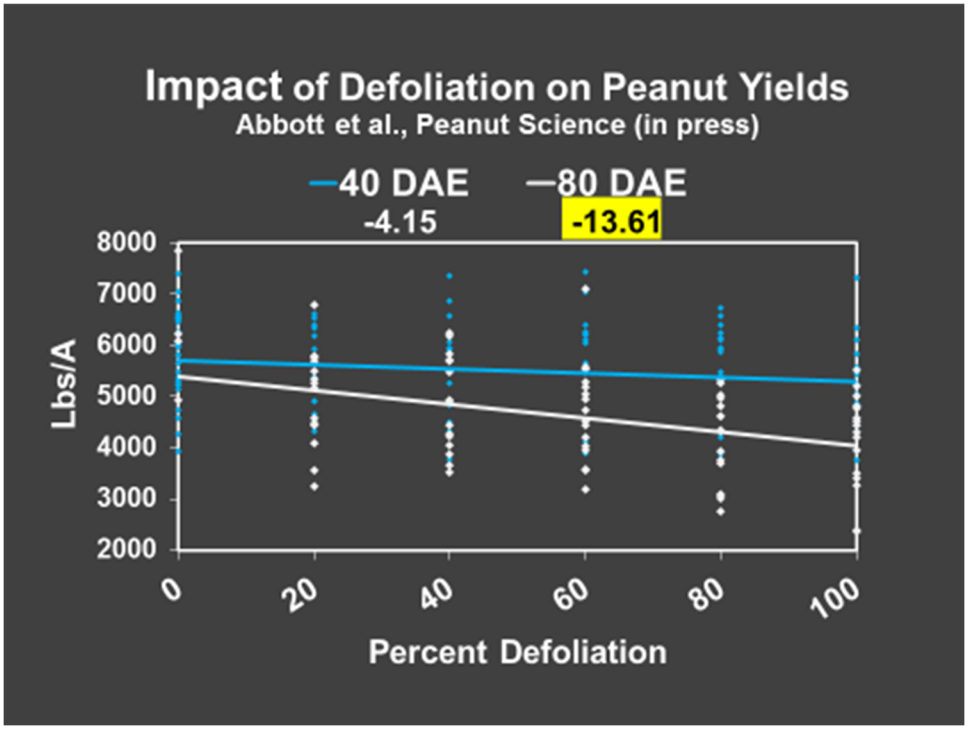

Figure 5. Relationship of peanut yield and a single manual hand defoliation event at different defoliation levels 40 and 80 days after emergence (DAE). *highlighted slopes are significant [Abbott et al. Peanut Science (in press)]

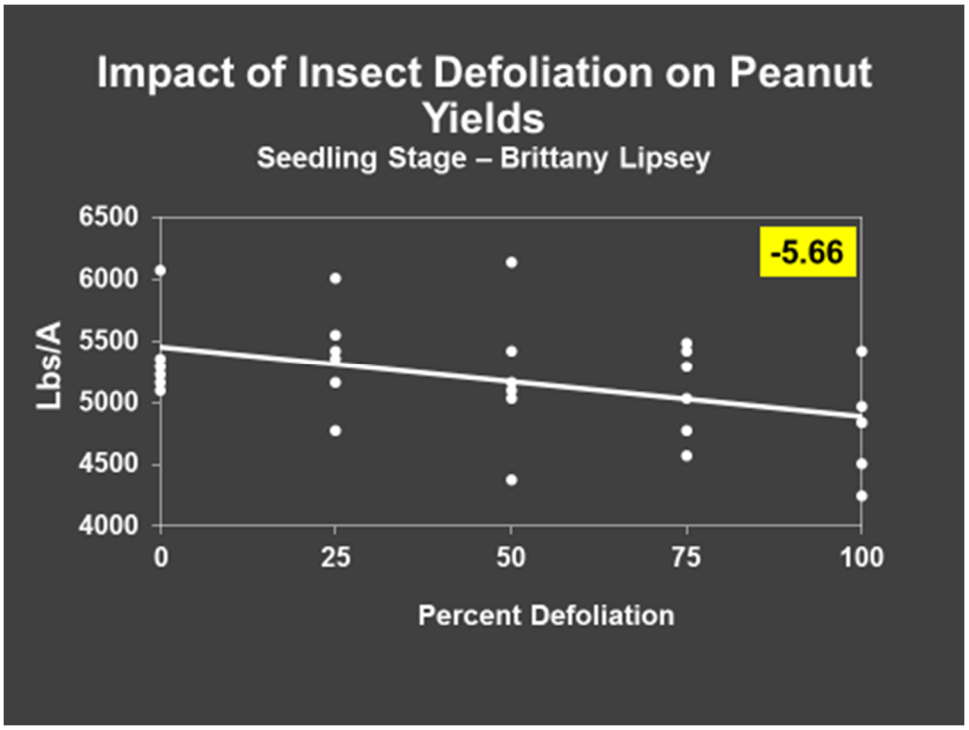

Figure 6. Relationship of peanut yield and a single manual hand defoliation event at different defoliation levels during seedling stages, 20 days after emergence (DAE) *highlighted slopes are significant

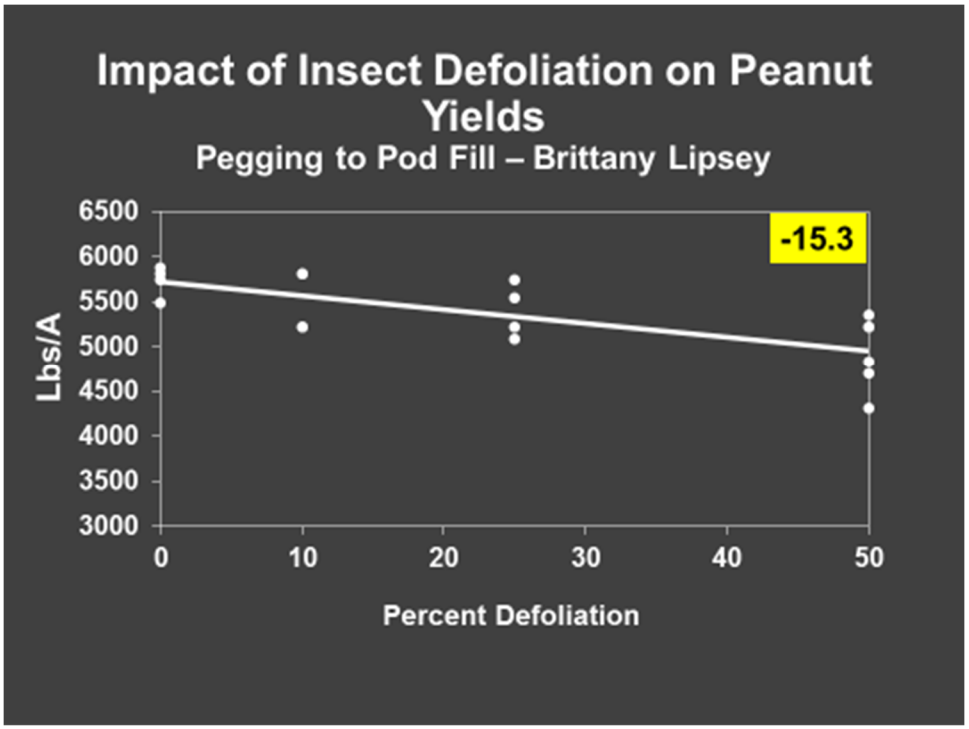

Figure 7. Relationship of peanut yield and incremental insect defoliation events at different defoliation levels during pegging to pod fill stages, 40-80 days after emergence (DAE) *highlighted slopes are significant

Summary

In summary, a sweep net threshold would be beneficial for farmers and consultants for accuracy of pest identification within the caterpillar pest complex. Small amounts of defoliation can potentially reduce yield significantly therefore a defoliation threshold would be beneficial for simplicity. Single hand defoliation events were similar to the results of incremental insect defoliations and maybe used to simulate insect defoliation in peanut. Given the current level of uncertainty in agriculture due to regulatory constraints limiting pesticide availability, high input costs, and low commodity prices, continuing to evaluate and refine action thresholds and improve the decision processes for growers will be critical to ensure long term sustainability.

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