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NATIONAL PEANUT BOARD / SOUTHEAST PEANUT RESEARCH INITIATIVE

FINAL REPORT/Summary for WORK DONE UNDER RESEARCH AGREEMENT #

INSTITUTION:	University of Georgia
PROJECT TITLE:	Biology, Ecology and Management of Insect Pests of Peanut in the Southeast US
RES. AGR. NO.:	
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NPB 2016 Final report

Three Cornered Alfalfa Hopper Economic Threshold Development

Three cornered alfalfa hopper (TCAH) infestations in peanut are often treated with insecticides, though the economic impact of the insect's feeding injury is poorly understood. The Peanut Entomology Program at the University of Georgia in Tifton has been conducting research on TCAH since 2014 with the goals of better understanding the insect's biology, developing effective monitoring procedures, and calculating economic injury levels that can be used to develop economic or "treatment" thresholds. NPB SPRI funded research in 2016 focused on quantifying the relationship between feeding injury (in the form of stem girdles) and pod yield.

Peanut (cultivar GA-06G) was planted in six 30ft long rows on 6ft centers using a hand push planter on 12 May 2016 at the University of Georgia Lang Farm in Tifton, GA. After seedling emergence, four one meter by one meter square hoop cages were placed in each row, and plants were thinned to a density of three plants per cage. The trial was irrigated, and the plants were managed according to University of Georgia Extension recommendations for runner type peanut.

Experimental treatments consisted of four TCAH densities: 0, 10, 20, and 30 insects per cage. Treatments were arranged in a randomized complete block design with each row representing one of six replications. Adult TCAHs were collected from an alfalfa field in Tifton, GA on 25 July using 15 inch sweep nets. The insects were transported to the laboratory, sorted by sex, and held in screen cages with alfalfa stems overnight. TCAHs were released according to the treatment densities into field cages at a sex ratio of 7 males: 3 females on 26 July. The plants remained caged until harvest. Cages were removed and all plant material was collected on 20 October. Pods were harvested from the plants, dried, and weighed. Feeding injury to all stems and petioles was quantified. There was significantly more feeding injury per plant in treatments with TCAH than in the no insect control, but no differences were observed in the number of stem girdles among the 10, 20, and 30 insect per cage treatments. The number of pods per plant and the pod weight per plant decreased numerically with increasing TCAH density, but no significant treatment effects were detected (Fig.1). Alone, these data provide only minimal information, but they will be combined with data from 2014, 2015, and 2017. Together these data will provide the foundation for preliminary economic injury levels and action threshold for three cornered alfalfa hopper in peanut.

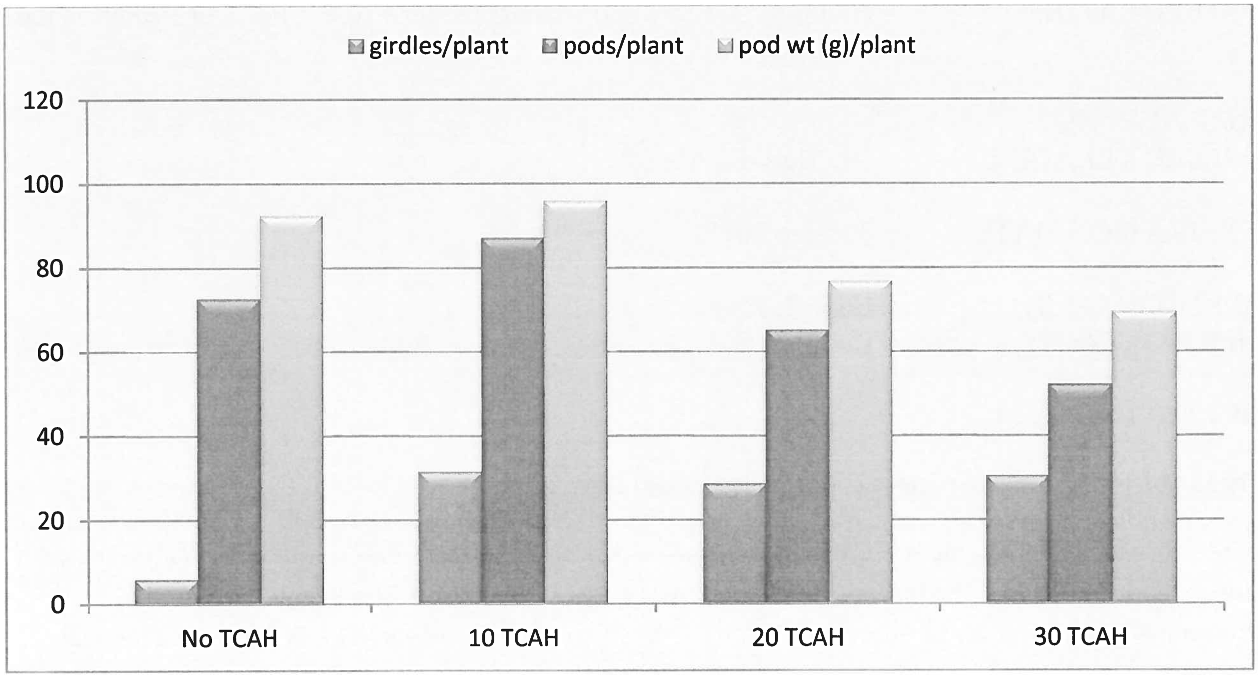

Figure 1. Average number of TCAH stem girdles, pods, and pod weight in grams per plant by insect density treatment in field cages in 2016.

Thrips Economic Threshold Development

Peanut production in the southeastern United States is threatened by several insect pests. Tobacco thrips, *Frankliniella fusca*, is one of the most important pests in peanut. As the predominant thrips species found in the Southeast, tobacco thrips not only cause severe feeding injury to peanut seedlings but also transmit *Tomato spotted wilt virus* (TSWV) the causal agent of spotted wilt disease of peanut. As more and better TSWV field-resistance peanut cultivars become commercially available, it is crucial to re-evaluate the importance of tobacco thrips direct feeding injury. The current lack of economic injury levels for thrips can lead to inefficient insecticide use as well as increased environmental risk and production cost. The relationship between feeding injury, damage, and thrips density must be established before an economic injury level can be calculated. A replicated field experiment was conducted with plant age at thrips infestation and thrips density per plant as the experimental variables in Tifton, GA. A peanut cultivar with moderate resistance to TSWV (Georgia-06G) was planted on three dates (about 10 days apart). Immediately after planting, 1x1 square meter field cages constructed of thrips proof screen were placed over the planted peanut row. After peanut emergence, plant density was thinned to three plants per cage. Thrips density treatments of 0, 5, 10, and 20 adult females per plant were randomly assigned to cages within each replicate. Thrips from the laboratory colony were released on a single date in all cages at 39, 28 and 18 days after the first, second, and third planting dates respectively. Thrips feeding damage was rated weekly starting at 7 days after thrips infestation for four consecutive weeks. The rating scale from 0 to 10 was used where 0 represents no injury and 10 represents dead plants. As the percentage of thrips feeding on leaves increases, the scale score increases. Thrips densities did not significantly affect feeding damage ratings. However, there was a significant interaction between plant age and rating date. In the two earliest ratings, the youngest peanut plants had significantly higher thrips feeding damage ratings (fig.2). In addition to feeding damage rating, plant height and width were measured to monitor plant growth. No significant effect of thrips density was observed on plant height and width. At 14 days after thrips infestation, one whole plant, including above and below ground plant parts, was removed from each cage and placed in a Berlese funnel to determine the number of adult and

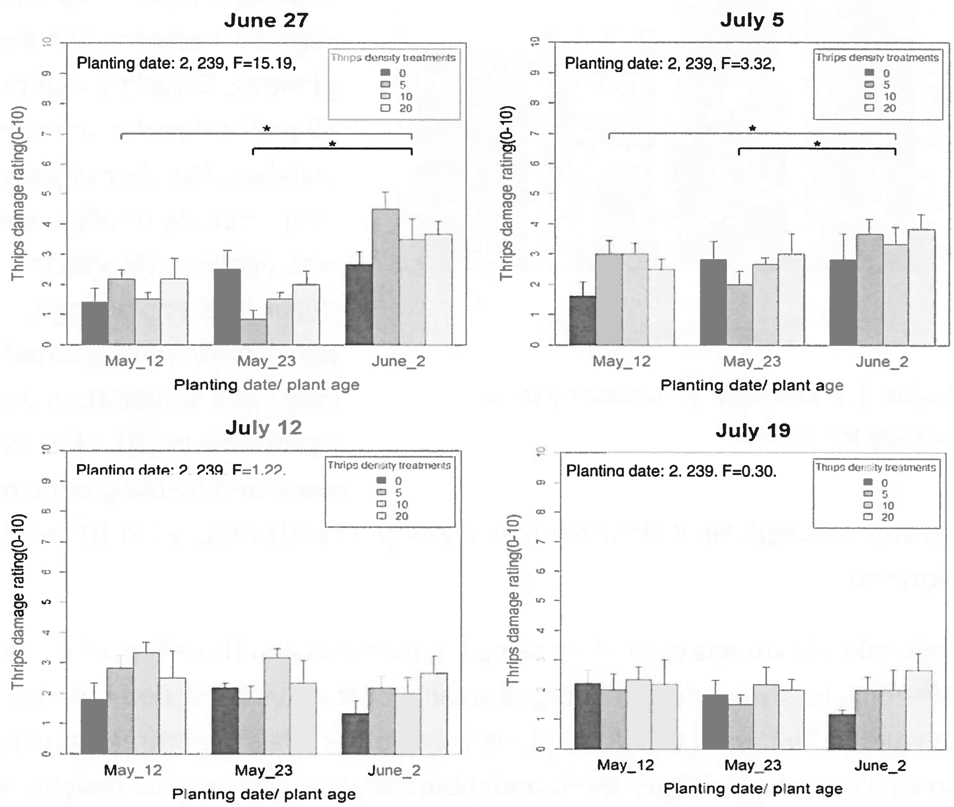

Figure 2. Thrips feeding injury rating by insect density and sample date in 2016.

immature thrips present. The total number of thrips did not vary with initial thrips density treatment or plant age. After thrips were removed and plants were completely dried, whole plant biomass was measured. Regardless of plant age, thrips density did not significantly affect peanut plant biomass. However, plant biomass was significantly reduced in the 20 thrips per plant treatment for plants aged 28 DAP at infestation. The remaining two plants were kept in the cage until harvest. Peanuts were harvested at 154 days after the first planting. Caged peanut plants were dug, and all pods on each plant were counted and weighed. Number of pods did not vary with thrips density or plant age, but, pod weight was significantly affected by thrips density. Regardless of plant age, 10 and 20 thrips per plant treatments resulted in significantly lower pod weight than 0 or 5 thrips per plant treatments (fig.3). After pods were picked, all above and below ground plant matter was dried and weighed. Final plant biomass was significantly reduced in 10 and 20 thrips per plant treatments.

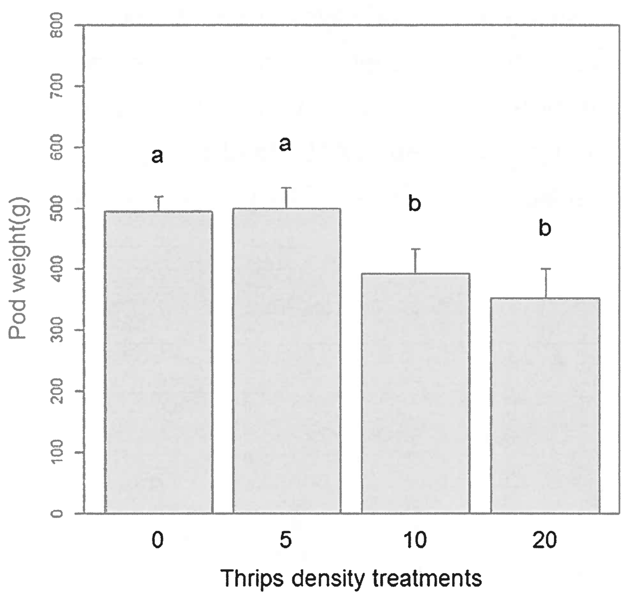

Figure 3. Pod weight at harvest by thrips density treatment.

Additional field studies evaluating sampling methods and the effect of thrips population density and feeding injury on yield in uncaged small plot trials were carried out in conjunction with the cage studies. This work will be combined with other trials over three years to create a data set from which economic injury levels and ultimately threshold will be developed.

Burrower Bug Population Dynamics and Management

The peanut burrower bug has caused significant economic losses for peanut producers in Georgia since 2010. Very little is known about the biology of this potentially devastating pest, and much of what is known about management comes from studies conducted in South Carolina in the 1990's and early 2000's. A light trap network was established in 2015 in 13 peanut producing counties in GA to identify patterns in burrower bug distribution and monitor flight activity during the peanut production season. Traps were deployed in 2015 and 2016 in or adjacent to peanut fields. Traps were equipped with timers and were set to operate from 800hrs to 000hrs on Sunday and Monday and Wednesday and Thursday each week from May/June until peanut harvest. Trap contents were collected twice each week, placed in re-sealable plastic bags labeled with location and date information and stored in a laboratory freezer. All peanut burrower bugs in each sample were counted. In addition to the number of bugs, additional data were collected from each trap site including GPS location, irrigation status, FSIS peanut grade, tillage practice, soil type, insecticide use, and previous year's crop. These data will be used to conduct correlation analyses as the data set increases in size with additional trapping years.

Peanut burrower bugs were collected at every trap location in 2015 and 2016 (fig. 4). This suggested that the insect is widely distributed in Georgia and does occur in counties with little or no history of measurable burrower bug injury to harvested peanut. The number of bugs collected varied widely from location to location but variation by location was lower in 2016 than in 2015. Season patterns of trap capture suggest that the insect may complete a generation each month (fig. 5). This finding is similar to what has been observed regarding burrower bug development time in lab reared insects, but suggests a greater number of generations per year than what has been previously proposed in the scientific literature. Ongoing efforts seek to confirm this result and understand the potential implications for insect damage and peanut quality.

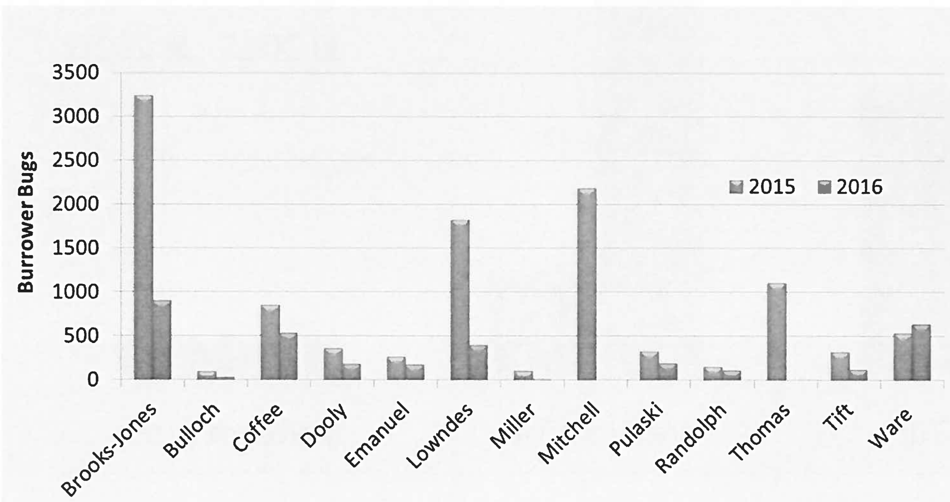

Figure 4. Number of burrower bugs collected in light traps in 13 Georgia Counties in 2015 and 2016.

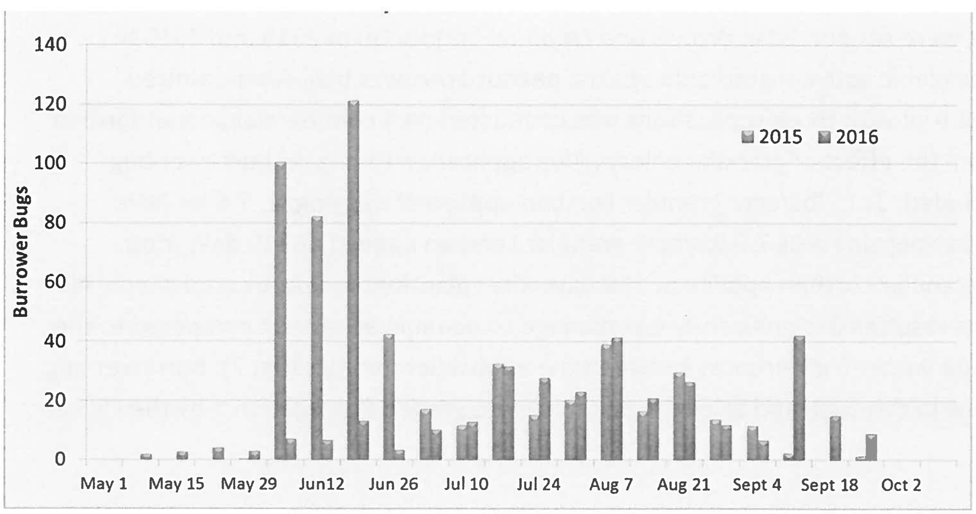

Figure 5. Mean number of burrower bugs per light trap (all traps at all locations) by week in 2015 and 2016.

A study was conducted on a commercial farm in Brooks County, GA to evaluate the effect of tillage type on burrower bug damage at harvest. The trial was arranged in a randomized complete block design with three pre plant tillage treatments and three replications. Plots were 80 ft wide by approximately 1000 ft long. Treatments included deep till, vertical till, and strip till and were applied by the grower in early spring prior to planting. Other than tillage, all plots were managed identically during the growing season. Yield and damage data were collected at harvest. There were no statistically significant differences in yield or burrower bug damage by treatment (fig. 6). Nevertheless, a strong numerical trend was observed in 2015 and 2016 indicating that damage is reduced in deep tillage plots. The two years of data will be combined into a single analysis in an attempt to increase our ability to discern a significant effect.

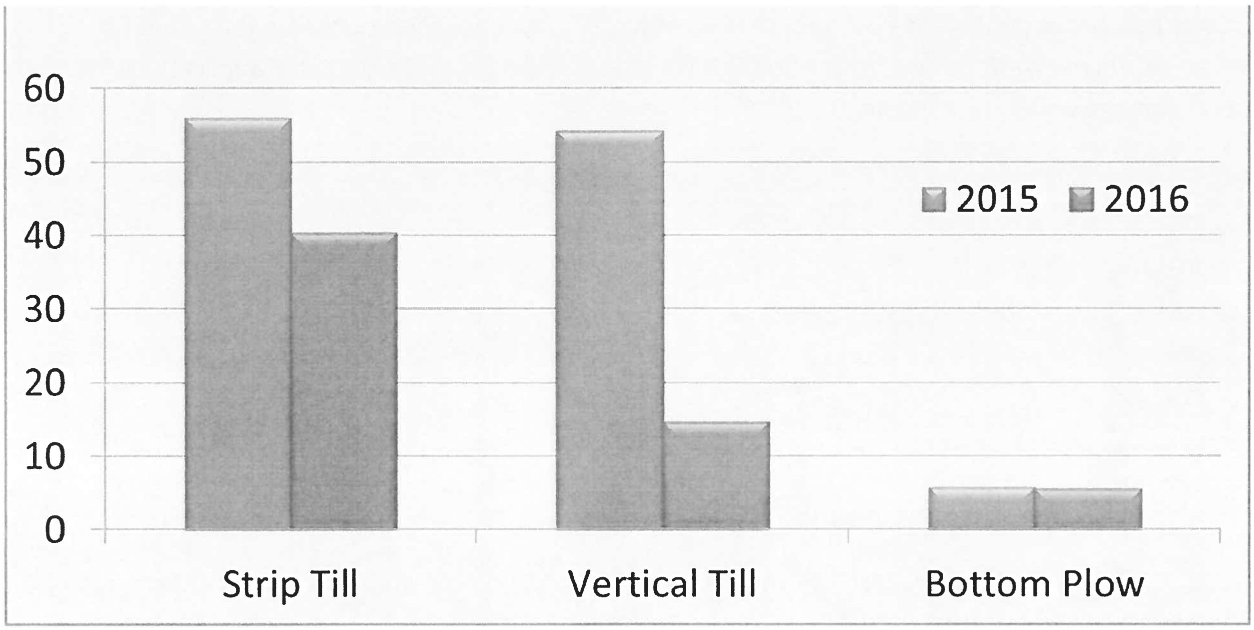

Figure 6. Average percent by weight of burrower bug damaged peanut seed at harvest by pre-plant tillage treatment in 2015 and 2016.

Insecticide efficacy trials were conducted in Brooks and Emanuel County GA in 2015 and 2016 to evaluate commercially available active ingredients against peanut burrower bug. A randomized complete block large plot trial with three replications was conducted on a commercial peanut farm in Brooks County to examine the effect of granular chlorpyrifos application timing on burrower bug damage. Treatments included: 1. 15 lbs/acre granular Lorsban applied at pegging; 2. 7.5 lbs/acre granular Lorsban applied at pegging plus 7.5 lbs/acre granular Lorsban applied at 110 days after planting; 3. 15 lbs/acre granular Lorsban applied at 110 days after planting; 4. Non-treated check. All three Lorsban treatments resulted in significantly less damage to peanuts at harvest compared to the untreated check, but there were no differences between the application timings (fig. 7). Burrower bug damage was relatively low in this trial, and all of the peanuts were graded Segregation 1 by the FSIS at the buying point.

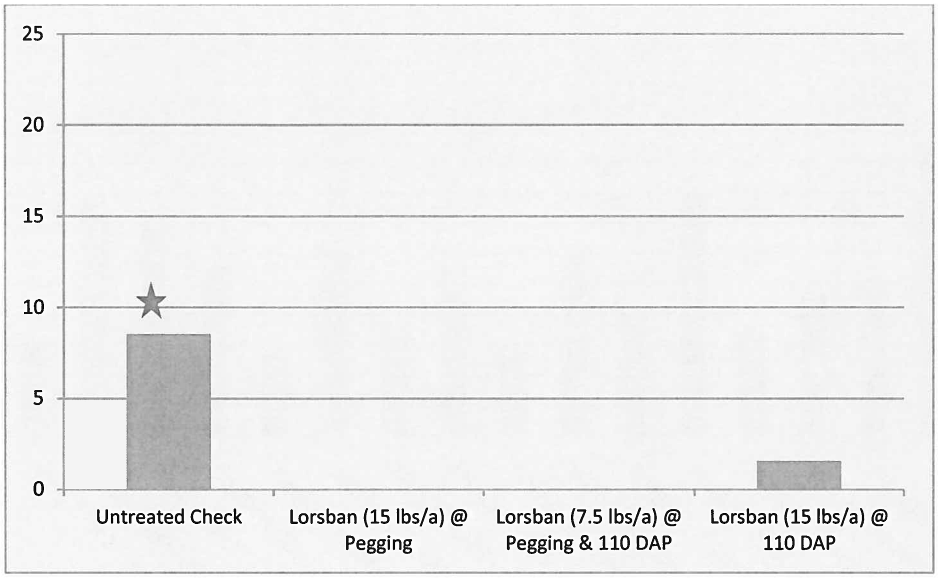

Figure 7. Average percent by weight of burrower bug damaged peanut seed at harvest by insecticide treatment.

A small plot insecticide efficacy study was conducted on a commercial peanut farm in Emanuel County in 2016 to evaluate several different insecticide active ingredients and day versus night time applications. The trial was arranged in a randomized complete block design and consisted of 18 treatments replicated four times. Plots were 4 rows wide by 40 ft long. Yield and damage data were collected at harvest from all plots. There were no significant differences between any of the treatments, and no obvious patterns related to application date or time of day were evident (fig. 8). We hypothesize that the plot sizes were too small to adequately evaluate the treatments considering the life history and mobility of the peanut burrower bug. Future experiments will focus on the most promising of the active ingredients tested and will use larger plots.

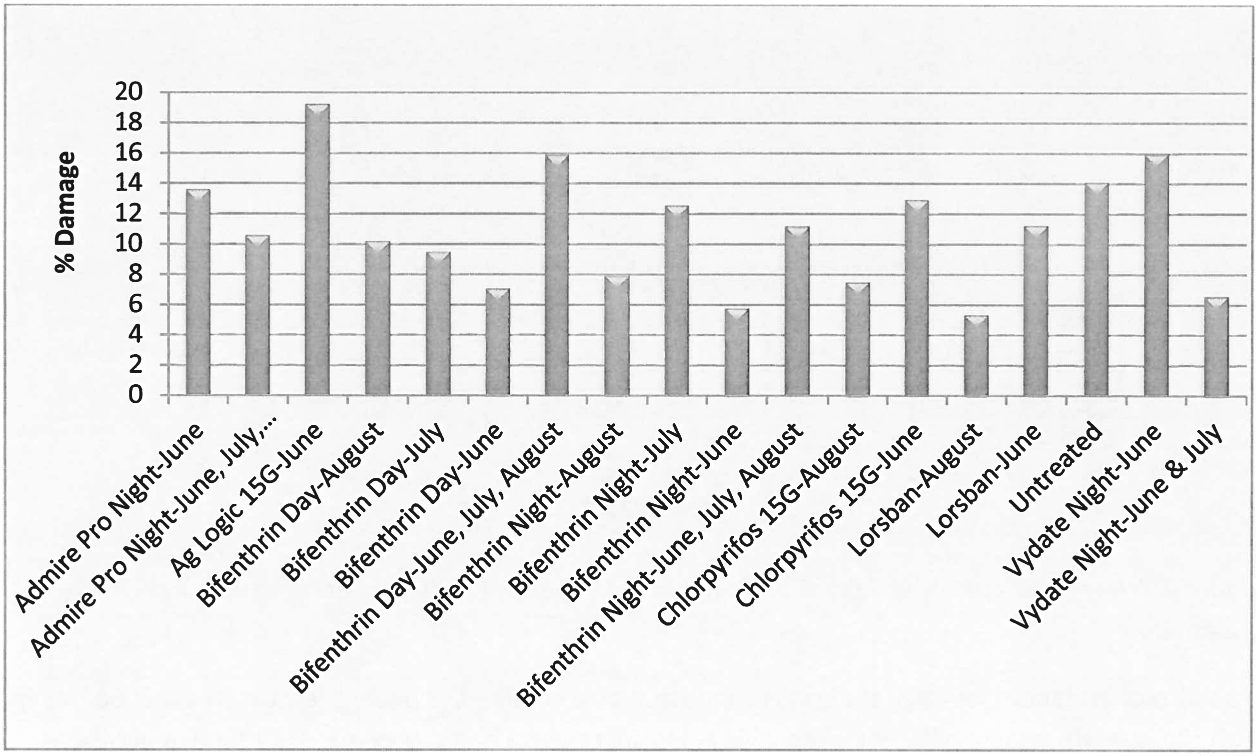

Figure 8. Average percent peanut burrower bug injury by weight to harvested seed by insecticide treatment and timing.

Cultivar response to insect damage

Host plant resistance is one of the most desirable pest management tactics in an integrated program as it requires no additional inputs from the producer and can provide very effective protection from pest injury. While most of Georgia's peanut acreage is planted to a single cultivar (GA-06G), there are several high yielding, commercially available alternatives for growers to consider. The agronomic traits of these cultivars are generally well known, but their relative susceptibility to insect pests has not been fully investigated. One of the foundations of integrated pest management is the systematic monitoring of pest populations and the use of economic thresholds for decision making. Recent grower surveys suggest that at least 50% of Georgia's peanut crop is not regularly scouted for insect pests. As part of a multi-year study conducted in cooperation with county Extension agents in Georgia and a research entomologist at Auburn University, a field trial was established on a University of Georgia research farm in Tifton, GA in 2016 to evaluate the effect of cultivar on insect infestations and to assess the efficacy of two insect management paradigms: Integrated pest management (IPM) vs. calendar based insecticide applications. The experiment was arranged in a randomized complete block design. Plot dimensions were 12ft x 30ft. Pest and beneficial insect populations were monitored weekly in all plots. All insecticide treatments were applied with a CO_2 powered, tractor mounted research plot sprayer delivering 15 gallons of finished spray solution per acre. Calendar based treatments included: acephate at 21 days after planting and three applications of Besiege at the first and third week of July and the second week of August. In the IPM based treatments, insecticides were applied based on insect density and established or putative economic thresholds. Cultivars tested included: Georgia-06G, Georgia-12Y, and Tifguard. Not unexpectedly, there were significant differences in yield by cultivar, but within cultivar, insect management strategy had no effect on yield. The IPM treatment regime never reached threshold for any pests and was not sprayed. These data will be combined with data from additional years and locations for analysis. The effects of cultivar and management regime will also be examined at the level of individual pest and beneficial insect species.