Report to Arkansas Soybean Promotion Board

Title: Developing a New Threshold for Corn Earworm, *Helicoverpa zea*

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Production System: Double Crop Soybean Production System

Status: Year 3 of 3*

What We Said We Would Do:

Specific Objectives:

1. Initiate studies for determining at what point CEW populations are causing economic damage to soybean which often impact the Double Crop Soybean Production System.
2. Determine the loss in yield associated with CEW populations in soybean. After determining loss associated to different population levels of CEW develop a threshold for growers and decision makers on when insecticide applications for control of CEW are justified to main maximum profit for soybean producers.
3. Evaluate efficiency of sampling methods for determining CEW populations in soybean.

What We Have Accomplished:

1. Cages were placed in soybeans at the CBES and NEREC and infested with moths, previous attempts have been unsuccessful when placing larvae on plants from artificial diet or from field collections. We had success the past 2 seasons by putting moths in cages and allowing the moths to mate and lay eggs in the cages. This was a significant success in helping us develop a method for infestation. Larvae were allowed to eat for one week then removed. We have compiled our data with colleagues in surrounding states also conducting the study and are currently analyzing data. By working with the other states: MS, LA, TN we will be able to determine yield loss at varying levels of infestation by pooling data and reaching a conclusion faster than doing it ourselves.
2. We collected data from several locations in Arkansas comparing sweep net and shake sheet. This work is in conjunction with TN and MS. The data is currently being analyzed but initial observations indicate the correlation between the two sampling methods is not as clear cut as previously thought. The drop cloth appears to underestimate populations.

Results

During 2012-2013, field cage studies were conducted using an indeterminate maturity group 4.6 soybean variety. The treatments in this study were moth mating duration and non-infested. Plots, except the non-infested control plots, were infested with approximately 10 pair of corn earworm pupae just prior to the R1-R2 stage. Adults were removed at 5, 7, 9 and 11 days after emergence to give a range of larval densities. Larvae were then sampled at ten days after the final adult removal with a drop cloth. This sample represents a total damage measurement for the cohort of larvae. After the final density sample was recorded, total pods and damaged pods were counted on 2.5 row feet. Yield measurements were recorded at the end of the growing season.

A significant relationship between pod damage and yield was observed (Figure 1A). **Based on the regression equation, for every corn earworm damaged pod yield was reduced by 0.04 bu/ac. A significant relationship between larval density and yield was also observed (Figure 1B). Based on the regression equation, for every corn earworm larvae present per 2.5 row feet yield was reduced by 1.3 bu/ac. Additional studies will be conducted to improve robustness of the data.**

During 2013, six field cage infestation studies were conducted. The same procedures were used as in 2012, however, bollworm adults infested in the cages failed to reproduce. The reasons for this are unknown. Additions to the methods including an additional food source in the cages for adults will be utilized during 2014 to help insure successful establishment and reproduction.

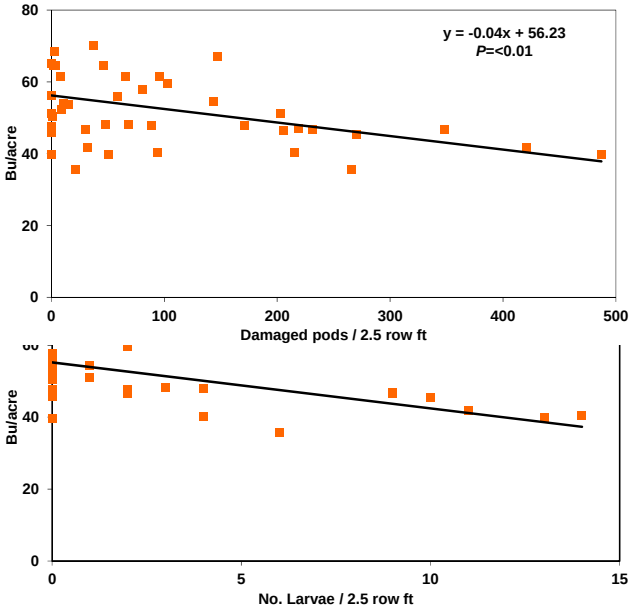
During 2012, the ability of soybean plants to compensate for insect injury was also evaluated. Corn earworm injury was simulated by removing 0% (control), 50%, or 100% of fruiting structures at R2, R3, R4, or R5. An indeterminate soybean variety and a determinate variety were both included in this study. Measurements were taken to determine delays in crop maturity along with crop yield. At harvest, 5 plants from each plot were mapped to determine fruit location and yield components.

For the indeterminate variety, significant maturity delays expressed as percent abscised leaves were observed. At 138 days after planting (DAP), the control plots averaged ca. 95% abscised leaves. While plots that received 100% fruit removal at R3 still retained 35% of their leaves. Similar results were observed when either of the fruit removal levels was applied at R4. Plots that received 50% or 100% fruit removal at R5 retained 45% and 60% of their leaves, respectively. For the determinate cultivar,

significant maturity delays expressed as percent abscised leaves were observed at 139 DAP. Plots that received 100% fruit removal at R4, 50% fruit removal at R5, or 100% fruit removal at R5 retained 40%, 40%, and 60% of their leaves, respectively. While plots that received any of the other treatments had abscised 80-90% of their leaves.

For the indeterminate cultivar, only fruit removal had a significant effect on yield (Table 1). As fruit removal increased yield decreased. For the determinate cultivar, both growth stage and fruit removal level had a significant effect on yield. Across fruit removal treatments, plots in which treatments were applied at R2 or R4 yielded significantly higher than plots in which treatments were applied at R5 treatments. Across growth stages, only 100% fruit removal significantly reduced yield.

For the indeterminate cultivar, three bean pods were the most critical component of yield, compared to



all other pods with two bean pods being the second most important. The R3 50% and 100% removal treatment had more total pods per plant than all other growth stages however it didn't have the highest yield, indicating that while increased pod load was important in compensation, it probably isn't as big of a factor as seed size and weight in yield compensation. For the determinate cultivar, two bean pods were the most critical component of yield followed by three bean pods. The R4 50% and 100% removals had significantly more total beans per plant than all other growth stages at their respective removal levels; however they didn't have the highest yields similar to the indeterminate cultivar. This again indicates that it's most likely that seed size and weight were more important to yield compensation than increased fruit load.

Figures 1A, 1B. Relationship between damaged pods per 2.5 row ft and soybean yield (1A) and relationship between number of larvae per 2.5 row ft and soybean yield.

Data for 2013 is currently being compiled from all states/ locations and analysis of the data is underway. Progress has been slow on this project while refining technique but we are making progress towards our goal of a threshold for soybean growers in Arkansas and the Mid-south.