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MANAGEMENT STRATEGIES FOR INSECT PESTS OF FIELD CORN AND SOYBEANS IN MISSISSIPPI

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Project Director
COOK, DO, .

Recipient Organization
MISSISSIPPI STATE UNIV
(N/A)
MISSISSIPPI STATE,MS 39762

Performing Department
Delta Research & Extension Center

Non Technical Summary
Significant changes have occurred in field corn production over the last 10 to 15 years. Introduction of corn hybrids with insect resistance traits (transgenic Bacillus thuringiensis traits) have provided southern corn growers with tools to effectively manage the corn borer complex (Southwestern corn borer, Diatraea grandiosella Dyar; sugarcane borer, Diatraea saccharalis (F.); and European corn borer, Ostrinia nubilalis (Hübner)). These transgenic Bt traits (YieldGard, and Herculex I) had little activity against ear feeding caterpillars, except Herculex I which has activity against fall armyworm, Spodoptera frugiperda (J.E. Smith). Newer Bt technologies (VT Triple Pro, SmartStax, and Viptera) that express more than one trait generally have substantially more activity against ear feeding caterpillars, particularly corn earworm, Helicoverpa zea (Boddie). Several studies have demonstrated the efficacy of Bt corn technologies against corn earworm infesting corn ears (Storer et. al., 2001, Buntin et. al., 2004a, Buntin et. al., 2004b). These studies used non Bt near isolines as comparisons for the transgenic Bt isolines, however differences in yield potential may exist between the transgenic and non-transgenic isolines. This increased efficacy has not consistently translated into yield increases (Chilcutt et al., 2007, Buntin (2008). Corn earworm has historically not been considered an economic pest of field corn, because there were no economical control measures for this insect. Because of this, the impact of corn earworm infestations field corn yield has not been fully investigated. Therefore, the value of newer Bt corn technologies cannot be adequately estimated with respect to corn earworm.Early season soil insect pests of corn are somewhat sporadic in Mississippi. When present, this pest complex can have a substantial impact on yield. This pest complex includes southern corn rootworm, Diabrotica undecimpunctata howardii Barber; wireworms, Elateridae; white grubs, Phyllophaga spp.; and seed corn maggot, Delia platura (Meigen); (Drees 1999, Eckenrode and Webb 1999, Keaster and Riley 1999, McCleod et al. 1999). Management considerations for the soil insect pest complex must be addressed at planting. The primary control measure for soil insect pests is insecticidal seed treatments, all of which are in the neonicotinoid class. With national and

global concerns of the impact of neonicotinoids on pollinators, alternative control measures for early season soil insect pests of corn need to be investigated.Historically, soybean production in the Mississippi Delta region of the mid southern United States involved planting Maturity Group V, VI, and VII varieties which were planted in May and June. Recently, growers have transitioned to Maturity Group IV and V varieties planted in April and May (Early Soybean Production System) (Heatherly 1999). Another aspect of this is that many of the Maturity Group V varieties and the Maturity Group VI and VII varieties have a determinate growth habit. In contrast, the Maturity Group IV and some of the earlier maturing Maturity Group V varieties have an indeterminate growth habit. This shift in production systems along with increased management intensity has lead to increases in yield potential (Heatherly and Bowers 1998). Soybean acreage in Mississippi has increased from 1.43 million acres in 2007 to 2.22 million acres during 2010 (Musser and Catchot 2008, Musser et al. 2011). Much of this increased acreage has been planted to later maturing varieties for logistical reasons. These varieties tend to be planted later which extends the growing season into late summer and early fall when insect populations are higher. Later maturing varieties are also subject to insect injury for a longer period of time.Corn earworm (i.e. bollworm) can be a very damaging pest of soybeans. This pest feeds on the flowers and developing pods causing direct yield loss. During 2008 to 2011, the number of acres in Mississippi infested with corn earworm has ranged from 650,000 to 1,100,000 and the number of acres treated has increased from 250,000 to 750,000 (Musser et al. 2009, 2012). Also, the average number of applications has ranged from 1 application to 2.1 during this period. For many years the treatment threshold for corn earworm in Mississippi was 15 larvae / 25 sweeps or 4 larvae / foot of row (Catchot et al. 2009). Many growers, consultants, and entomologists felt that this threshold was too high. Through discussions among university entomologists from Arkansas, Louisiana, Mississippi, Missouri, and Tennessee, the threshold was reduced to 9 larvae / 25 sweeps or 3 larvae per row foot during 2010. An extensive literature search found several studies investigating corn earworm thresholds in soybeans. These include McAllister et al. 1958, Kincade et al.1971, Smith and Bass 1971, Miller 1972, Smith and Bass 1972a, Smith and Bass 1972b, Stern 1973, Thomas et al. 1974, Boldt et al. 1975, Thomas et al. 1976, Mueller and Engroff 1980, McPherson and Moss 1989, Eckel et al. 1992. However, these studies were conducted many years ago using determinate Maturity Group 6 and 7 varieties. The results of several of these studies loosely correspond with the current treatment threshold recommendations. With the increase in number of insecticide applications for corn earworm, changes in production systems, and the increased value of soybeans, accurate and reliable treatment thresholds are critical.As with corn earworm, treatment thresholds for many soybean insect pests were developed many years ago when soybeans were produced using production practices that are very different from those currently used. Treatment threshold for insect pests must be refined / validated periodically as production practices, i.e. drastic changes in planting dates and varieties of different maturities, evolve.

Animal Health Component 0%

Research Effort Categories

Basic	(N/A)
Applied	100%
Developmental	(N/A)

Classification

Knowledge Area (KA)	Subject of Investigation (SOI)	Field of Science (FOS)	Percent
216	1510	1130	50%
216	1820	1130	50%

Knowledge Area
216 - Integrated Pest Management Systems;

Subject Of Investigation
1510 - Corn; 1820 - Soybean;

Field Of Science
1130 - Entomology and acarology;

Keywords

insect pest management soybean field corn

Goals / Objectives
Investigate the impact of infestations of ear feeding lepidopteran insects on yield of field corn and the value of transgenic Bt corn technologies.Evaluate the impact of early-season/soil insect pests on field corn and the performance of commercial and experimental management tools.Validate/refine corn earworm treatment thresholds for soybeans and investigate the impact of corn earworm infestations on indeterminate soybeans.Evaluate/refine current management strategies for insect pests (ex. stink bugs, corn earworm, threecornered alfalfa hopper, foliage feeding Lepidoptera) infesting soybeans and the performance of commercial and experimental management tools.

Project Methods
Objective 1. Studies will be conducted to examine the impact of infestations of ear feeding Lepidopteran insects on yield of field corn and the value of transgenic Bt corn technology. Several Bt corn technologies will be included in these studies. These technologies exhibit varying levels of efficacy against ear feeding lepidopteran insect pests infesting corn ears. The foliar insecticide applications will be used to create differential levels of kernel damage within a hybrid/technology. Comparisons will be made between the kernel damage and yield between the treated and non-treated plots within each hybrid/technology. This will allow for direct comparisons of yield, without differences in genetics and yield potential influencing the results. Ear damage will be quantified and yield will be determined. Grain samples will be collected from each plot for grain quality (i.e. physical damage) analysis and mycotoxin analysis. Mycotoxin analysis will be conducted by the Department of Biochemistry at Mississippi State University. Studies will also be conducted using field cages and infestations of adult insects to create varying levels of insect infestation. Additionally, simulated damage studies will be conducted to define critical levels of injury that result in significant yield losses. These studies will be conducted at one to two locations which will include the Delta Research and Extension Center in Stoneville and the R. R. Foil Research Farm at Starkville. The experimental design for these studies will be a randomized complete block design with a split plot treatment arrangement where appropriate. Data will be subjected to analysis of variance procedures or regression analysis where appropriate.Objective 2. Studies will be conducted to evaluate the impact of early season/soil insect pests on yield of field corn. Multiple experiments will evaluate the value of soil insecticides and insecticidal seed treatments in corn production. Plots will be sampled during the early vegetative growth stages to determine plant density, stand establishment, and impact on plant growth. These studies will be conducted at one to two locations which will include the Delta Research and Extension Center in Stoneville and the R. R. Foil Research Farm at Starkville. The experimental design for these studies will be a randomized complete block design with a split plot treatment arrangement where appropriate. Data will be subjected to analysis of variance procedures.Objective 3. Studies will be conducted to validate/refine current treatment thresholds for corn earworm infesting soybean. Indeterminate soybeans will be utilized in these studies and infestations will be targeted during the reproductive growth stages. Corn earworm will be infested in plots covered with field cages. Non-infested cages will be included for comparison. Plots will be sampled to determine larval density and level of damage. Following infestations, plant growth measurements will be taken to evaluate impact on vegetative growth. Soybean maturity will be monitored in all plots to determine the impact of corn earworm infestations on crop maturity and plots will be harvested to determine yield. Also, simulated damage studies will be conducted to determine extent of compensation for injury and the impact of injury on crop maturity. These studies will be conducted at one to two locations which will include the Delta Research and Extension Center in Stoneville and the R. R. Foil Research Farm at Starkville. The experimental design for these studies will be a randomized complete block design with a split plot treatment arrangement where appropriate. Data will be subjected to analysis of variance procedures.Objective 4. Multiple experiments will be conducted to evaluate/refine current management strategies for insect pests infesting soybeans. These

studies will be conducted on the research station and on growers' farms depending on availability of insect infestations. The experimental design for these studies will be a randomized complete block design with a split plot treatment arrangement where appropriate. Data will be subjected to analysis of variance procedures.

Progress 10/01/16 to 09/30/17

Outputs
Target Audience:Mississippi Producers Mississippi Agricultural Consultants' Association Agricultural chemical company and distributor representatives Changes/Problems: Nothing Reported What opportunities for training and professional development has the project provided?Research findings were presented at grower meetings, field days, and demonstrations. Specific research was presented at one scientific meeting, two large technical meetings targeting growers and consultants, sixteen local consultant/ grower oriented meetings, and one national field tour sponsored by the Entomological Society of America. How have the results been disseminated to communities of interest?Research findings were presented at grower meetings, field days, and demonstrations. Specific research was presented at one scientific meeting, two large technical meetings targeting growers and consultants, sixteen local consultant/ grower oriented meetings, and one national field tour sponsored by the Entomological Society of America. What do you plan to do during the next reporting period to accomplish the goals?Some studies will be continued. For others, data are being summarized for publication and/or presentation.

Impacts
What was accomplished under these goals? Studies were initiated during 2015 using simulated damage methods to determine the critical level of kernel damage required to impact corn yield. Individual ears were assigned randomly to the simulated damaged treatments which included 0, 10, 20, 40, 60, or 100 kernels. Previous studies of this type utilized hand harvest the current study utilizes harvest machinery. These studies are currently being summarized. Studies were initiated during 2014 to evaluate the economic value of transgenic Bt corn. These studies are not complete, but preliminary results indicate that single trait Bt hybrids with minimal activity against corn earworm (for corn borer management) are of greater economic value to growers than multiple trait hybrids that exhibit greater activity against corn earworm. Results from these studies are currently being summarized Multiple trials evaluated current and alternative management practices for early-season/soil insect pests have been conducted during 2017, and are currently being summarized. Studies were initiated to investigate the impact of stink bug infestations and feeding on corn seedling. The 2017 studies were preliminary and results will be used to refine studies for 2018. Field experiments were initiated at Stoneville, Mississippi during 2016 to evaluate fruiting structure removal level and removal timing on soybean growth, crop maturity, and yield under conditions that may limit yield potential such as non-irrigated production systems. These studies are being summarized. Experiments were initiated during 2016 to evaluate the value of neonicotinoid seed treatments in soybean with regard to prevention of catastrophic stand loss and replant avoidance. These studies are ongoing. In the Mississippi Delta, soybean looper is a major insect pest infesting soybeans. Changes in insecticide performance have been observed for several years. Multiple trials were conducted to evaluate the performance of insecticides recommended for soybean looper management. Changes in insecticide performance continue to be observed. Studies were initiated during 2017 to refine/validate the soybean looper threshold in soybeans and to determine the relationship between soybean looper densities and defoliation. These studies are ongoing. Studies were initiated during 2017 to refine/validate the treatment threshold for redbanded stink bug infesting soybean. Also studies were initiated to determine at what reproductive growth stage(s) soybean is most susceptible to redbanded stink bug and at what growth stage soybean is safe from redbanded stink bug damage. These studies are ongoing.

Publications

- Type: Journal Articles Status: Awaiting Publication Year Published: 2017 Citation: North, J. H., J. Gore, A. L. Catchot, S. Stewart, G. Lorenz, F. Musser, D. R. Cook, D. Kerns, B. R. Leonard and D. M. Dodds. 2017. Value of neonicotinoid insecticide seed treatments in Mid-South corn (Zea mays) production systems. J. Econ. Entomol. Doi: 10.1093/jee/tox278.

Progress 10/01/15 to 09/30/16

Outputs
Target Audience:Mississippi Producers Mississippi Agricultural Consultants' Association Agricultural chemical company and distributor representatives Changes/Problems: Nothing Reported What opportunities for training and professional development has the project provided?Research findings were presented at grower meetings, field days, and demonstrations. Specific research was presented at two scientific meetings and seven large consultant/ grower oriented meetings. How have the results been disseminated to communities of interest?Research findings were presented at grower meetings, field days, and demonstrations. Specific research was presented at two scientific meetings and seven large consultant/ grower oriented meetings. What do you plan to do during the next reporting period to accomplish the goals? Publish completed projects and continue ongoing projects

Impacts
What was accomplished under these goals? Studies were initiated during 2013 using simulated damage methods to determine the critical level of kernel damage required to impact corn yield. Individual ears were assigned randomly to the simulated damaged treatments which included 0, 10, 20, 40, 60, or 100 kernels. During 2013, a significant relationship between kernel damage and yield was observed. Analysis of data indicated a significant relationship between kernel damage and yield. Based on the regression equation, for every kernel damaged ca. 0.15g of grain yield was lost. This was a component of a MS student's project. The student has successfully defended his thesis. In addition to this project, studies were initiated during 2015 using the same levels of damage and procedures. These additional studies differed from the original ones in that plots were machine harvested instead of hand harvested. These studies are ongoing. Studies were initiated during 2014 to evaluate the economic value of transgenic Bt corn. These studies are not complete, but preliminary results indicate that single trait Bt hybrids with minimal activity against corn earworm (for corn borer management) are of greater economic value to growers than multiple trait hybrids that exhibit greater activity against corn earworm. Multiple trials evaluated current and alternative management practices for early-season/soil insect pests have been conducted during 2016, but are not complete. Studies were conducted during 2012 to 2014 to refine/validate corn earworm thresholds in soybeans. These studies are complete and were published during 2016. Also results from these studies were utilized to develop an economic threshold considers crop value and cost of control. This threshold has been published in the Mississippi Insect Control Guide to be more available to growers and consultants. Field experiments were initiated at Stoneville, Mississippi during 2016 to evaluate fruiting structure removal level and removal timing on soybean growth, crop maturity, and yield under conditions that may limit yield potential such as non-irrigated production systems. These studies are ongoing. Experiments were initiated during 2016 to evaluate the value of neonicotinoid seed treatments in soybean with regard to prevention of catastrophic stand loss and replant avoidance. These studies are ongoing. In the Mississippi Delta, soybean looper was the primary insect pest infesting soybeans. Multiple trials were conducted to evaluate the performance of insecticides recommended for soybean looper management. Most materials evaluated resulted in reductions in soybean looper densities for ca. 7 days following application. However, populations began to increase in all plots after 7 days after application. The diamide insecticides have been the standard for soybean looper management since their introduction and have provided excellent control of soybean looper for 21 to 28 following application. In experiments conducted during 2016, none of the products evaluated, including the diamides, were capable of preventing populations from increasing beyond 7 days after application.

Publications

- Type: Theses/Dissertations Status: Published Year Published: 2016 Citation: Adams, B., D. R. Cook, A. L. Catchot, J. Gore, F. Musser, S. D. Stewart, D. L. Kerns, G. M. Lorenz, J. T., Irby, and B. R. Golden. 2016. Evaluation of corn earworm, Helicoverpa zea (Lepidoptera: Noctuidae), economic injury levels in Mid-South reproductive stage soybean. J. Econ. Entomol. 109: 1161-1166. Crespo, A. L. B., A. P. Alves, Y. Wang, B. Hong, J. L. Flexner, A. L. Catchot, D. Buntin, and D. R. Cook. 2016. Survival of corn earworm (Lepidoptera: Noctuidae) on Bt maize and cross-pollinated refuge ears from seed blends. J. Econ. Entomol. 109: 288-298. North, J. H., J. Gore, A. L. Catchot, S. Stewart, G. Lorenz, F. Musser, D. R. Cook, D. Kerns, and D. M. Dodds. 2016. Value of neonicotinoid insecticide seed treatments in Mid-South soybean (Glycine max L.) production systems. J. Econ. Entomol. 109: 1156-1160. Reisig. D. D.,

D. S. Akin, J. N. All, R. T. Bessin, M. J. Brewer, D. G. Buntin, A. L. Catchot, D. Cook, K. L. Flanders, F-N. Huang, D. W. Johnson, B. R. Leonard, P. J. McLeod, R. P. Porter, F.P.F. Reay-Jones, K. V. Tindall, S. D. Stewart, N. N. Troxclair, R. R. Youngman, and M. E. Rice. 2015. Lepidoptera (Crambidae, Noctuidae, and Pyralidae) injury to corn containing single and pyramided Bt traits, and blended or block refuge, in the Southern United States. J. Econ. Entomol.108: 157-165. Bibb, J. L. 2015. Impact of corn earworm on field corn yield and grain quality. MS Thesis. Mississippi state University. December 2015

Progress 10/01/14 to 09/30/15

Outputs
Target Audience:Mississippi Producers Mississippi Agricultural Consultants Association Agricultural chemical company and distributor representatives Changes/Problems: Nothing Reported What opportunities for training and professional development has the project provided?Research findings were presented at grower meetings, field days, and demonstrations. Specific research was presented at scientific meetings. How have the results been disseminated to communities of interest?Research findings were presented at grower meetings, field days, and demonstrations. Specific research was presented at scientific meetings. What do you plan to do during the next reporting period to accomplish the goals?Continue research projects and continue to provide information to target audience

Impacts
What was accomplished under these goals? Studies were initiated during 2013 and continued during 2014 using simulated damage methods to determine the critical level of kernel damage required to impact corn yield. Individual ears were assigned randomly to the simulated damaged treatments which included 0, 10, 20, 40, 60, or 100 kernels. A significant relationship between kernel damage and hand harvest yield was observed. Based on the regression equation, for every kernel damaged (ca. 0.27g) of grain yield was lost. Additional studies were conducted during 2015 using the same treatments and procedures, with the exception of plots being machine harvested. Preliminary results indicate that kernel damage of <20 per ear did not significantly reduce machine harvest yields. Studies were initiated during 2014 to evaluate the economic value of transgenic Bt corn. Preliminary analysis indicates that in the absence of corn borer infestations that there was no yield or economic advantage of planting Bt corn compared to non Bt corn. These studies were continued during 2015 and expanded to include more locations Multiple trials evaluated current and alternative management practices for early-season/soil insect pests in corn and soybean were conducted during 2014. These studies were continued during 2015. Preliminary results indicate that there are treatments that are comparable to neonicotinoid seed treatments. However, all of these potential alternatives must be applied in-furrow and require additional attachments to planting equipment for application. Field cage studies were conducted using an indeterminate maturity group 4.6 soybean variety. The treatments in this study were moth mating duration of 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. Based on the regression equation, for every one percent of corn earworm damaged pod yield was reduced by 0.37 bu/ac. A significant relationship between larval density and yield was also observed. Based on the regression equation, for every corn earworm larvae present per row feet yield was reduced by 1.3 bu/ac. Also, for every corn earworm captured using sweep net sampling (25 sweep sample) yield was reduced by 0.17 bu/ac. Economic injury levels were calculated using these data for various commodity prices and costs of control. These data are currently being developed for publication. Also economic thresholds are being developed using these data. Field experiments were conducted in Starkville and Stoneville, Mississippi during 2012 and 2013 to evaluate fruiting structure removal level and removal timing on soybean growth, crop maturity, and yield for both determinate and indeterminate soybean. Fruit removal treatments consisted of 0, 50, and 100% of all fruiting structures removed at specific soybean growth stages. These fruit removal levels were imposed at the R2, R3, R4, and R5.5 growth stages. Plant heights were determined at least bi-weekly from the time damage was imposed until R7. The impact of fruit removal level and timing on crop maturity was determined by estimating the

percentage of naturally abscised leaves at 137 DAP when control plots were approximately 10-15 days from harvest and the percentage non-senesced main stems at 139 DAP. There was no significant impact of fruit removal timing or fruit removal level on plant height or canopy width. Significant delays in crop maturity were observed as determined by percent non-abscised leaves and percent non-senesced main stems when fruit removal was imposed at the R5.5 growth stage. Significant reductions in yield and crop value were observed as early as R3 and R4 when 100% of fruit was removed. Both fruit removal levels at R5.5 also resulted in a significant reduction in yield and crop value compared to the non-treated control. Indeterminate soybeans appear to have the ability to compensate for some fruit loss during the early to middle reproductive growth stages. However, infestations of pod feeding caterpillars should be managed accordingly to avoid costly delays in crop maturity and yield losses. Data for indeterminate soybean has been published and data for determinate soybean is being prepared for publication. Studies were initiated during 2015 to quantify delays in soybean crop maturity results from fruit loss, such as from corn earworm feed. These studies were initiated at R5, the growth stage identified in the studies described above as being more sensitive to fruit loss. These studies are ongoing. Numerous studies have been conducted to evaluate insect management strategies for corn and soybean pests. Results from these studies are will continue to be used to refine insect management recommendations.

Publications

- Type: Journal Articles Status: Published Year Published: 2015 Citation: Adams, B, A. Catchot, D. Cook, J. Gore, F. Musser, J.T. Irby, B. Golden. 2015. Impact of Simulated Corn Earworm Damage in Indeterminate Soybean. J. Econ. Entomol. 108:1072-1078. Crespo, A. L., B., A. P. Alves, Y. Wang, B. Hong, J. L. Flexner, A. Catchot, D. Buntin, and D. Cook. 2015. Survival of corn earworm (Lepidoptera: Noctuidae) on Bt maize and cross-pollinated refuge ears from seed blends. J. Econ. Entomol. DOI: http://dx.doi.org/10.1093/jee/tov272

Progress 07/01/14 to 09/30/14

Outputs
Target Audience: Mississippi Producers Mississippi Agricultural Consultants’ Association Agricultural chemical company and distributor representatives Changes/Problems: Nothing Reported What opportunities for training and professional development has the project provided? Research findings were presented at grower meetings, field days, and demonstrations. Specific research was presented at three scientific meetings. How have the results been disseminated to communities of interest? Research findings were presented at grower meetings, field days, and demonstrations. Specific research was presented at three scientific meetings What do you plan to do during the next reporting period to accomplish the goals? Nothing Reported

Impacts
What was accomplished under these goals? Studies were initiated during 2013 using simulated damage methods to determine the critical level of kernel damage required to impact corn yield. Individual ears were assigned randomly to the simulated damaged treatments which included 0, 10, 20, 40, 60, or 100 kernels. During 2013, a significant relationship between kernel damage and yield was observed. Preliminary analysis of the 2013 data indicated a significant relationship between kernel damage and yield. Based on the regression equation, for every kernel damaged (ca. 0.15g) of grain yield was lost. Additional studies are being conducted during 2014 but are not complete. Studies were initiated during 2014 to evaluate the economic value of transgenic Bt corn. These studies are not complete at this time. Multiple trials evaluated current and alternative management practices for early-season/soil insect pests have been conducted during 2014, but are not complete. Field cage studies were conducted using an indeterminate maturity group 4.6 soybean variety. The treatments in this study were moth mating duration of 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. 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. 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 were conducted during 2014 but are not complete. Field experiments were conducted in Starkville and Stoneville, Mississippi during 2012 and 2013 to evaluate fruiting structure removal level and removal timing on soybean growth, crop maturity, and yield. Fruit removal treatments consisted of 0, 50, and 100% of all fruiting structures removed at specific soybean growth stages. These fruit removal levels were imposed at the R2, R3, R4, and R5.5 growth stages. Plant heights were determined at least bi-weekly from the time damage was imposed until R7. The impact of fruit removal level and timing on crop maturity was determined by estimating the percentage of naturally abscised leaves at 137 DAP when control plots were approximately 10-15 days from harvest and the percentage non-senesced main stems at 139 DAP. There was no significant impact of fruit removal timing or fruit removal level on plant height or canopy width. Significant delays in crop maturity were observed as determined by percent non-abscised leaves and percent non-senesced main stems when fruit removal was imposed at the R5.5 growth stage. Significant reductions in yield and crop value were observed as early as R3 and R4 when 100% of fruit was removed. Both fruit removal levels at R5.5 also resulted in a significant reduction in yield and crop value compared to the non-treated control. Indeterminate soybeans appear to have the ability to compensate for some fruit loss during the early to middle reproductive growth stages. However, infestations of pod feeding caterpillars should be managed accordingly to avoid costly delays in crop maturity and yield losses. Experiments were conducted during 2012 and 2013 in DREC to evaluate the impact of higher than threshold densities of threecornered alfalfa hopper. During 2012 and 2013, infestations of 60 TCAH adults/row ft during R3-R4 growth stages resulted in no yield loss. In the Mississippi Delta, especially at Stoneville, bean leaf beetle was the primary insect pest infesting soybeans during 2013. Multiple trials were conducted against bean leaf beetle. Premixes / tank mixes of pyrethroids and neonicotinoid or organophosphate insecticides provided good control of bean leaf beetle infestations (Tables 2, 3, 4, and 5). Also, Sevin performed well against bean leaf beetle. Generally, pyrethroids applied alone did not perform as well compared to premixes / tank mixes of a pyrethroid plus a neonicotinoid or organophosphate.

Publications

- Type: Journal Articles Status: Under Review Year Published: 2014 Citation: Adams, B, A. Catchot, D. Cook, J. Gore, F. Musser, J.T. Irby, B. Golden. 2014. Impact of Simulated Corn Earworm Damage in Indeterminate Soybean. J. Econ. Entomol. (in review)
- Type: Journal Articles Status: Published Year Published: 2014 Citation: Cook, D. R., S. D. Stewart, J. E. Howard, D. S. Akin, J. Gore, B. R. Leonard, G. M. Lorenz, and J. A. Davis. 2014. Impact of Simulated Threecornered Alfalfa Hopper (Hemiptera: Membracidae) Induced Plant Loss on Yield of Maturity Group IV and V Soybeans. J. Entomol. Sci. 49:176-189.