Impact of Brown Marmorated Stink Bug (Halyomorpha halys) on Lima Beans

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Methods

'C-Elite' lima beans were planted on June 28, 2013 and May 12, 2016 at the University of Delaware's Research farm located in Newark, DE to evaluate the feeding effects of brown marmorated stink bug (BMSB) on lima beans. In 2013, plots were 15 ft. long by 10 ft. wide (four rows planted on 30 inch centers including a border row) and in 2016, plots were 15 ft. long by 15 ft. wide (six rows planted on 30 inch centers including border rows). Plots were arranged in a randomized split plot design with 8 replications. At the initiation of the experiment (Aug 5, 2013 and June 29, 2016), each of the plants used in the experiment were caged with a nylon mesh bag secured to the ground with landscape staples around the base of the plant and tied at the top. The cages remained over the plants until harvest regardless of the infestation timing to limit unwanted insects from re-infesting the plants. In 2016, some of the plants experienced moderate to severe defoliation from Mexican bean beetles. Plants were artificially infested at three infestation timings (plant growth stages); flowering, pinning, and pod fill with four bug densities; 0, 1, 3, and 5 BMSB adults per plant for a period of 7 days. Plants were infested with naturally occurring field populations of BMSB adults in 2013. In 2016, bugs were obtained from Phillip Alampi Beneficial Insect Laboratory, New Jersey Department of Agriculture, Trenton, NJ. After the week long infestation period, the bugs were removed from the cages and recorded as live, dead, or missing. In 2016, dead bugs were replaced daily.

At harvest (Sep 25, 2013 and August 9, 2016), the pods were stripped from the plants, counted, and examined for external puncture wounds. Shelled beans were then counted and examined for evidence of stink bug feeding damage, recording the total number of damage beans and the number of puncture wounds per damaged bean. Puncture wounds per damaged bean were not recorded in 2016.

Data were analyzed using analysis of variance (ANOVA) by using mixed effects model (PROC MIXED procedure) and means were separated using Tukey's mean separation test. Years were analyzed separately.

Table 1. 2013 brown marmorated stink bug feeding injury assessment

Infestation Timing/Density		# of Pods	# of Beans	% Damaged Beans	Avg # of Puncture Wounds
Infestation Timing	Flowering	11.5a	26.4a	0.1a	0a
	Pinning	13.0a	30.6a	1.39a	0ab
	Pod Fill	11.1a	25.8a	7.7b	0.21c
Infestation Density	0	12.1a	31.2a	0.3a	0a
	1	12.4a	30.0a	1.5ab	0.3a
	3	11.9a	25.1a	3.0ab	0.1a
	5	11.0a	23.4a	7.5b	0.2a

Means in the same columns followed by the same letter are not significantly different (Tukey's; P=0.05)

Table 2. 2016 brown marmorated stink bug feeding injury assessment

Infestation Timing/Density		# of Pods	# of Beans	% Damaged Beans
Infestation Timing	Flowering	60.6a	151.5a	0.24a
	Pinning	62.7a	147.2ab	0.21a
	Pod Fill	48.5a	107.2b	2.64b
Infestation Density	0	42.2a	106.9a	0.12a
	1	45.4a	111.5a	0.53a
	3	44.0a	96.4a	0.28a
	5	40.2a	91.0a	2.16a

Means in the same columns followed by the same letter are not significantly different (Tukey's; P=0.05

Results

There were no significant differences for the number of pods or number of beans for infestation timing and density in 2013 (Table 1). In 2016, the timing of infestation and infestation density did not have an effect on the number of pods per plant; however, the infestation timing did for the number of beans per plant. Infestations initiated during the pod fill stage resulted in fewer beans per plant compared to flowering stage infestations (Table 2).

The timing of infestation had a significant effect on the percentage of damaged beans in 2013 and 2016 with infestations occurring during the pod fill stages having the greatest percentage of damaged beans compared to when infestations were initiated at earlier growth stages (Table 1 & 2). Infestation density was also significant for the percent of damaged beans in 2013. Densities of 5 bugs per plant resulted in a higher percentage of beans with stink bug feeding injury compared to the check (Table 1). There were no significant differences for the percent of damaged beans in 2016 regardless of the infestation density (Table 2). The average number of puncture wounds per damaged bean was significantly higher when infestations occurred during the pod fill growth stage compare to when infestations occurred during flowering or pinning stage in 2013 (Table 1). Furthermore, infestation density did not have a significant impact on the average number of puncture wounds on the beans.

Discussion

These results suggest that BMSB infestations occurring between flowering and pod fill do not have a significant impact on the number of pods set. However, BMSB infestations can cause beans to abort, reducing the total number of beans per plant, especially when infestations occur during the pod fill stage. Pod and bean abortion from stink bug feeding has been documented in other leguminous crops. The greatest percentage of damaged beans and greatest number of puncture wounds per bean was recorded when infestations were initiated during the pod fill stage. This suggests that the pod fill growth stage is the most sensitive to BMSB feeding and infestations occurring during this time can result in bean abortion and injury. The density of bugs also influenced the percentage of damaged beans. A

significant increase in the percentage of damaged beans occurred when densities reached 5 BMSB per plant.