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EFFECT OF PIGWEED ON BEET ARMYWORM ACTIVITY IN COTTON

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Abstract

Texas High Plains cotton losses due to beet armyworms, *Spodoptera exigua* (Hübner), have increased over the last ten years. This study was conducted in 2002 and 2003 to determine the influence of cotton planting date window (timely vs. late) and level of pigweed infestation (pigweed-infested vs. non-infested) on beet armyworm population abundance in Texas High Plains cotton. In both 2002 and 2003, planting date window did not influence seasonal differences in beet armyworm infestation. For both years, the presence or absence of pigweed contributed significantly to differences in seasonal beet armyworm activity in nearby cotton. In 2002, pigweed-infested cotton was observed to have a seasonal average of 3,240 larvae per acre compared with a significantly lower count of 1,015 larvae per acre in the clean-tilled non-infested cotton. Under lighter beet armyworm population levels in 2003, a seasonal average of 1,065 worms/acre was observed in pigweed-infested plots while only 195 worms/acre were detected in the plots without pigweed. The results of this study suggest that cotton fields infested with a preferred wild host, such as pigweed, have an increased risk for beet armyworm colonization.

Introduction

Historically, the beet armyworm, *Spodoptera exigua* (Hübner), has been considered an occasional pest in Texas High Plains cotton, usually associated with hot and dry weather conditions. Because of increasing levels of infestation and damage, the beet armyworm is now considered a secondary pest (Parajulee and Slosser 2000). In the Texas High Plains region, cotton losses attributed to beet armyworms have increased over the last 10 years. For example, 5 bales, 15,000 bales, 38,500 bales, and 581,000 bales were lost to beet armyworms in 1992, 1995, 1998, and 2000, respectively (Williams 2002).

In addition to climatic factors and natural enemy levels, the presence of noncotton weed hosts, particularly pigweed (*Amaranthus* spp.), is believed to influence beet armyworm seasonal activity and abundance (Huffman et al. 1996). Our field observations and reports by scientists from other regions of the U. S. cottonbelt suggest that beet armyworms prefer pigweed to cotton for initial colonization (Sappington et al. 2001). However, there is no information on the effect of pigweed on beet armyworm abundance and activity in cotton that is in close proximity to a pigweed source.

The objective of this study was to determine the influence of cotton planting date and the level of pigweed infestation on beet armyworm population abundance in Texas High Plains cotton. Results of the study will aid in developing cultural control strategies for beet armyworms in cotton.

Materials and Methods

The study was conducted in 2002 and 2003 at the Texas A&M University Agricultural Research and Extension Center located northeast of Lubbock, Texas. The experiment consisted of two main effects, each with two levels and four replications, arranged as a 2x2 factorial in a randomized complete block design (RCBD). The two factors were planting date window (timely vs. late) and level of pigweed infestation (pigweed-infested vs. non-infested).

Each of the 16 experimental plots was 20-row (40-inch) by 150 ft. Paymaster 2379RR was selected as the cultivar used in the study. The cotton received furrow irrigation with one pre-plant and three in-season irrigation applications each year.

Each year, eight timely-planted plots were planted within the Texas High Plains optimum planting window (2002 = 10 May; 2003 = 14 May) while the eight late-planted plots were planted approximately four weeks later (2002 = 14 June; 2003 = 13 June) which closely represents the crop insurance replanting cut-off date for the High Plains region. Field plot layout was identical for both years.

Pigweed infestation level treatments included: 1) eight 20-row clean cultivation (non-infested) cotton plots and 2) eight 20-row cotton plots with the middle four rows infested with pigweed plants (i.e., 8 rows of cotton on each side of the 4-row pigweed-infested cotton area). The ends of the pigweed-infested rows were clean-tilled to allow for a small weed-free buffer between non-infested plots and the closest pigweed plants. In the pigweed-infested plots, the 4-row by 75 ft area to which pigweed plants were confined occupied slightly less than 10% of the total plot area.

Seasonal activity of beet armyworm larvae in cotton was monitored during the growing season using a modified dropcloth method. Only cotton plants were sampled for larvae and all areas sampled in the pigweed-infested plots were at least 3.3 ft away from the nearest pigweed plants. On each sample date, a total of 46-row ft per plot was sampled to determine larval density. Dropcloth counts were converted to numbers per acre for data analysis and presentation. Data were analyzed using analysis of variance (SAS Institute 2000), with planting date, pigweed infestation level, and planting date x pigweed infestation level interaction as sources of variation. Fisher's protected least significant difference test (pLSD) was used to test the differences in mean abundance among treatments. Mean comparisons were evaluated at α=0.05.

Green bucket traps containing beet armyworm specific pheromone caps (Trece, Inc.) were used to monitor adult beet armyworm populations around the study site. An effort was made to correlate pheromone trap catches and larval densities throughout the study period.

Results and Discussion

In both years, trap captures of beet armyworms indicated low moth activity until mid-July. In 2002, numerous beet armyworm moths were present throughout the larval sampling period; however, the moth activity trend did not follow the larval population activity observed in the experimental cotton plots (Table 1). Beet armyworm larval activity began in late July, peaked in mid-August, and declined after mid-August without chemical intervention, while moth response to pheromone traps indicated increasing adult populations until the peak response (178.8 moths/day) was observed on 3 September. Lower numbers of moths were captured in traps throughout the season in 2003 (Table 1). Beet armyworm larval numbers in cotton were also lower than in 2002. Larval sampling was initiated on 9 August 2003 soon after the first beet armyworms were detected in the test plots and an average density of 1,314 larvae per acre was observed across all test plots. Beet armyworm numbers declined after this first sample date, indicating that the larval peak occurred at or near the time of the 9 August sampling date. The peak trap capture of 40.5 moths/day occurred on 26 August which represents approximately an 18-day delay between larval and adult population peak activity. This same pattern was observed in 2002 with larval and adult peak activity observed on 16 August and 3 September, respectively.

During 2002 and 2003, cotton planting window did not significantly affect beet armyworm activity levels (Table 2). With the exception of two 2002 inspection dates (11 and 23 August), larval numbers did not significantly differ between the timely and late-planted treatment plots. Seasonal mean numbers of beet armyworm larvae in timely and late-planted plots also did not differ in either year (Table 2).

Table 3 shows that on all sample dates (2002 and 2003) beet armyworm larval numbers in cotton with a nearby source of pigweed were numerically higher, in some cases with very large differences. The differences were significantly higher on six of 10 total sampling dates. Though some of the weekly counts failed to separate, seasonal mean numbers of beet armyworm larvae in pigweed-infested plots were significantly greater than numbers in clean-tilled plots in both years (Table 3). This gives a clear indication that a nearby source of pigweed influences beet armyworm infestation levels in cotton. We speculate that the influence of pigweed would have been more pronounced had our test plots been larger resulting in wider separation between the pigweed-infested and non-infested cotton areas. A larger plot size would likely result in less "bleeding over" of egg-laying moths attracted by pigweed into the nearby non-infested cotton areas. In the current study, some of the outside rows of the non-infested plots were within 26.7 ft (8 rows x 3.33 ft/row) of pigweed plants growing in the infested plots.

The results of the study strongly suggest that cotton fields infested with a preferred wild host, such as pigweed, likely have a higher risk for beet armyworm colonization.

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Table 1. Seasonal abundance of beet armyworm moths captured in pheromone traps and estimated population density of beet armyworm larvae in experimental cotton plots. Lubbock, TX.

2002			
Trap sampling date	**Moths captured / day**	**Larval sampling date**	**Larvae / acre**
23 Jul	24.1	28 Jul	1116
2 Aug	27.1	4 Aug	1642
7 Aug	29.3	11 Aug	2708
14 Aug	30.5	16 Aug	5672
22 Aug	43.1	23 Aug	1518
29 Aug	101.1	28 Aug	107
3 Sep	178.8		
11 Sep	33.2		
2003			
Trap sampling date	**Moths captured / day**	**Larval sampling date**	**Larvae / acre**
8 Aug	6.3	9 Sep	1314
11 Aug	8.3	18 Aug	515
20 Aug	13.9	25 Aug	621
26 Aug	40.5	9 Sep	71
3 Sep	18.9		
12 Sep	10.3		

Table 2. Average number of beet armyworm larvae per acre detected in timely and late planted cotton plots. Lubbock, TX.

2002							
	28 Jul	**4 Aug**	**11 Aug**	**16 Aug**	**23 Aug**	**28 Aug**	**Seasonal**
Timely planted	788 a	1758 a	4244 a	7440 a	1154 b	89 a	2579 a
Late planted	1444 a	1527 a	1172 b	3906 a	1882 a	124 a	1676 a

2003					
	9 Aug	**18 Aug**	**25 Aug**	**9 Sep**	**Seasonal**
Timely planted	1882 a	284 a	604 a	0 a	740 a
Late planted	746 a	746 a	639 a	142 a	639 a

Means within columns followed by different letters are statistically different (P<0.05).

Table 3. Average number of beet armyworm larvae per acre detected in pigweed-infested and non-infested cotton plots. Lubbock, TX.

2002							
	28 Jul	**4 Aug**	**11 Aug**	**16 Aug**	**23 Aug**	**28 Aug**	**Seasonal**
Pigweed-infested	1773 a	2770 a	4190 a	8079 a	2450 a	178 a	3240 a
Non-infested	460 a	515 b	1225 b	3267 b	586 b	36 a	1015 b

2003					
	9 Aug	**18 Aug**	**25 Aug**	**9 Sep**	**Seasonal**
Pigweed-infested	2308 a	888 a	923 a	142 a	1157 a
Non-infested	320 a	142 b	320 b	0 a	222 b

Means within columns followed by different letters are statistically different (P<0.05).