COTTON RESPONSE TO PRE-SQUARE TERMINAL INJURY FROM VARIOUS SIZES OF TARNISHED PLANT BUG NYMPHS

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RESEARCH PROBLEM

Tarnished plant bugs [*Lygus lineolaris* (Palisot de Beauvois)] can move onto cotton from proximate wild host plants when those plants senesce or are sprayed with herbicides. For example, in a reduced tillage production system where herbicide application for weeds is delayed until after crop emergence, adult plant bugs present on weed hosts may move on to pre-squaring cotton and feed and/or fly to other areas. Movement of immature plant bugs is more restricted, and plant injury from their feeding activity could be severe. The objective of this study was to determine how feeding by plant bugs of different ages in pre-squaring cotton affect plant development, maturity, and yield.

BACKGROUND INFORMATION

The tarnished plant bug is a key pest in mid-South cotton (Tugwell et al., 1976). In pre-squaring cotton, the terminal portions of plants are preferred feeding sites (Layton, 1995). Injury from tarnished plant bug feeding at this crop stage can cause a loss of apical dominance, which can result in multiple terminals per plant, a condition sometimes referred to as "crazy cotton" (Scales and Furr, 1968). Reduced growth following terminal injury of pre-squaring cotton can delay development of squares and crop maturity and reduce yield if optimal growing conditions do not allow for compensatory growth (Wene and Sheets, 1964; Strong, 1970; Hanny et al., 1977). In studies with *Lygus hesperus* Knight, Wene and Sheets (1964) found that pre-square injury by adults resulted in a 4-week delay in squaring; lint yield reduction of 224 kg/ha (200 lb/acre); suppression of the growing point; prevention of development of true leaves;

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and produced plants with multiple main stems. When this feeding occurred during cool weather, the percent of plants producing multiple stems was almost double that from injury during warm weather. Strong (1970) reported that as little as 20 min. of feeding by *L. hesperus* destroyed the terminal of seedling cotton resulting in cessation of growth. With no further injury to the plant, re-growth of a new terminal occurred in about 10 days. Given adequate time and resources, the crop can recover from terminal injury with no reduction of yield (Brook et al., 1992) or costly yield penalties.

RESEARCH DESCRIPTION

The variety Stoneville 4892 was planted on Wildy Farms near Manila (Mississippi County) on 8 May. No insecticides were applied at planting. The soil is a sandy, excessively drained part of the Routon-Dundee-Crevasse complex. Furrow irrigation began on 15 June and continued weekly until 3 September. One post-emergence herbicide application of 0.66pt/acre of Caparol (prometryn) post direct and 1.5pt/acre of Direx (diuron) under a hood was made on 15 June. Plots were 4 rows wide and 30 feet long. After plant emergence, 10 ft of row that contained 15 healthy plants were marked off within the 2 center rows of each plot and all treatments and data collection were subsequently made on these plants.

The following treatments were initiated when cotton had grown 2 true leaves: (1) an uninfested check, (Control; (2) one first-second instar (Sm Bug) per plant; (3) one third instar (Med Bug) per plant; and (4) one fifth instar (Lg Bug) per plant. Bugs were released 15 days after planting. Nymphs of the appropriate size were aspirated into glass vials and placed in a small cooler containing ice for transfer to the field. Nymphs were allowed to walk out of the vials or were gently poured from the vial directly on true leaves. Care was taken to ensure that the bugs were clinging to the plant after release. Tarnished plant bug nymphs were obtained from a colony maintained on artificial diet at the USDA-ARS Biological Control and Mass Rearing Unit at Mississippi State, MS (Cohen, 2000).

At 9 and 18 days after release of bugs, the number of plants with terminal damage (withered, flagged, or aborted), active terminal growth (new unfurled growth of a leaf), and number of true leaves per plant were recorded. Plants were monitored weekly through cutout using COTMAN™ (Danforth and O'Leary, 1998). Weekly insecticide applications of Provado 1.6F (imidacloprid) (0.047 lb ai/acre) were made to uninfested check plots on 11, 19, 26 June and 2 July. All plots were sprayed on 20 July [Orthene 90S (1/3 lb/acre)] and 1 and 11 Aug [Centric 40 WG (3 oz/acre)]. Defoliant was applied on 1 Oct. One row from each plot was hand harvested on 17 September, 28 September, 17 October, and 29 October. The cumulative weight per plot of each harvest was used to calculate the mean maturity date for each treatment (Richmond and Ray, 1966; Bourland et al., 2001). The mean maturity date is equal to the sum of each sequential harvest weight times the number of days after planting for each harvest date divided by the sum total weight of harvest.

RESULTS AND DISCUSSION

Results from plant injury assessments indicated that injury from Med Bug and Lg Bug treatments was significantly greater than Sm Bug and Control treatments (Table 1). At 18 DAT, plants in the Med Bug and Lg Bug treatments contained significantly fewer true leaves per plant than plants in the Check and Sm Bug treatments, indicating a developmental delay in plants injured by Med and Lg Bugs (Table 1).

The average plant height of the infested plots was 2 to 3 inches shorter than the Check plots, (6.75 inches) at the time of post-direct application of herbicide on 15 June. Selectivity of post-emergence herbicide applications was reduced because of the plant height differences. Some plants injured by tarnished plant bugs did not survive the combination of plant bug and herbicide injury. Initial squaring was delayed in all tarnished plant bug-treated plots; on 18 June (41DAP) the mean number of squares per plant was 2.5 in Check plots and 0 in treated plots. On 27 June (50 DAP) there was a significant difference in the number of plants per plot producing squares, 54% (Med bug), 58% (Lg Bug), 84% (Control), and 82% (Sm Bug). Differences were observed for plant height, number of sympodial nodes, and number of squaring nodes on all sampling dates (data not shown). Mean number of squaring nodes for each treatment was plotted as nodes above first square and nodes above white flower in COTMAN growth curves (Fig. 1). When compared to the COTMAN target development curve, it is apparent that square initiation in all plots was delayed. This common delay was probably related to the cool weather immediately after planting. Once squaring began, a significant delay was noted between treatments. No plots reached physiological cutout (NAWF=5) prior to 9 Aug (93 DAP), the latest possible cutout date for the study area. Based on historical weather data, a flower on this date has a 50% probability of accumulating the necessary heat units (850 DD60's) required for boll maturation. There were no differences between treatments in days to cutout (NAWF=5). The mean maturity date shows a significant delay of 6 days between the Control and Lg Bug treatments (P =0.02). Yields were significantly lower in the Lg Bug treatments compared to other treatments in the first two harvests, on 17 and 28 Sept; however, by 17 and 26 Oct there were no differences between treatments (Table 2).

PRACTICAL APPLICATION

While no significant yield reduction resulted from plant bug-induced injury, there was a trend for lower yields apparent in the plots infested with large nymphs. A significant delay in crop maturity was observed where large nymphs were released. Favorable weather conditions allowed the injured plants ultimately to compensate for injury caused by plant bug nymphs. In some years, crop delay from plant bug injury would force the crop to mature at the end of the season when insect pest pressure is high and when weather conditions unfavorable for crop termination are more likely.

Accurate early season scouting will allow timely detection of plant bugs and enable the grower to avoid crop delay associated with severe plant bug infestations. Growers should time herbicide applications to burn down spring weed hosts before cotton is established to eliminate the risk of plant bugs moving from in-field weed hosts directly onto the crop.

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Table 1. Percent of plants with actively growing terminals and mean number of true leaves per plant determined at 9 and 18 days after release of 1 TPB nymph per plant onto cotton at 2-leaf stage[z].

	Plants with actively growing terminals		Mean number true leaves/plant	
Treatment	9 DAT[y]	18 DAT	9 DAT	18 DAT
	------------ (%) ------------			
Check	67.3	85.8	1.8	3.7
Sm Bug	56.3	76.5	1.7	3.1
Med Bug	34.2	39.8	1.5	1.5
Lg Bug	20.5	32.5	1.5	1.7
P > F	0.002	0.002	0.11	0.01
$MSD_{0.05}$	27.3	34.0		1.8

[z] Bugs were released 15 days after planting.
[y] Days after treatment.

Table 2. Yield response to terminal injury treatments following release of TPB nymphs on 2-leaf stage cotton[z].

	Mean lint yield for each date of harvest			
Treatment	17 Sep	28 Sep	17 Oct	29 Oct
	---------------------------------- (lb/acre) --------------------------------			
Check	379	588	1130	1264
Sm Bug	297	472	1053	1287
Med Bug	286	486	992	1171
Lg Bug	188	313	763	951
P > F	0.02	0.02	0.13	0.12
$MSD_{0.05}$	152	210		

[z] Lint yield was calculated as 33% of seedcotton weight.

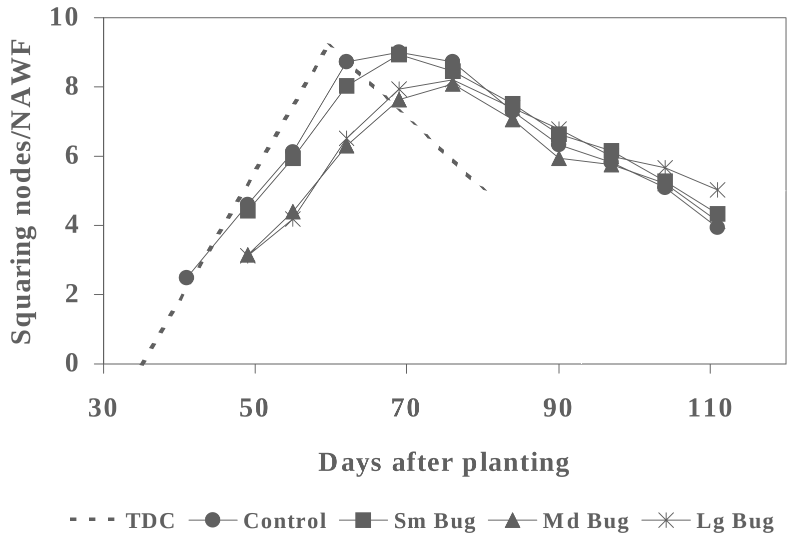
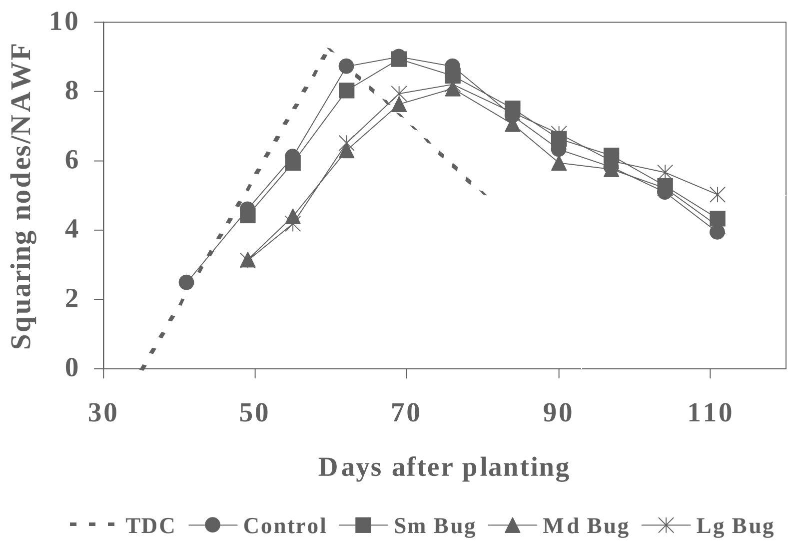


Fig. 1. COTMAN target development curve (TDC) and crop growth curve for untreated control plants and plants on which small, medium, and large TPB nymphs were released at the 2-leaf stage. The latest possible cutout date for the production region is 9 August which occurred 93 days after planting for this study.



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