INFLUENCE OF BOLL AGE ON SUSCEPTIBILITY TO TARNISHED PLANT BUG INJURY

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Abstract

Bolls with age determined by heat unit accumulation after anthesis were subjected to adult tarnished plant bug attack. Studies were conducted for two years, 1997 and 1998. Injury measurements were made on bolls to determine influence of boll age on susceptibility to tarnished plant bug injury. The results indicated that bolls that have accumulated 250 HU are relatively safe from tarnished plant bug injury.

Introduction

The tarnished plant bug, *Lygus lineolaris* (Palisot de Beauvouis), is an economically important pest in the family Miridae. Many Miridae species are phytophagous and cause damage to a variety of cultivated crops. The tarnished plant bug is the most prevalent lygus pest species found in the eastern cotton belt (Latson et al., 1977). Tarnished plant bug is generally recognized as an early season pest but may infest both presquaring and late season cotton. Tugwell et al. (1976) reported that most of the economic damage by the tarnished plant bug occurs between square initiation and early bloom. Early season injury results in terminal abortion and loss of apical dominance, both of which may induce vegetative growth and delayed maturity (Scales and Furr 1968, Wene and Sheets 1964, Tugwell et al. 1976). Tarnished plant bug injury to bolls has been characterized by Pack and Tugwell (1976) as a dull dark blemish with a pinhead size black spot in the center. Feeding on immature bolls can cause damage to lint and seed. However, the effect on yield of late season feeding on bolls by tarnished plant bug is not well known.

Late season insecticide treatment for control of certain boll feeding insects can be terminated when the latest effective bolls become mature enough to tolerate or escape insect injury. Bagwell and Tugwell (1992) showed that bolls which had accumulated 350 heat units (HU) after anthesis were relatively safe from injury by bollworm, tobacco budworm, and boll weevil. Bourland et al. (1992), Zhang et al. (1993), Cochran et al. (1994), and Harris et al. (1997) showed that when the last effective flowers in a cotton crop had accumulated 350 HU, insecticide treatments for control of bollworm, tobacco budworm, and boll weevil could be terminated with no adverse yield effect. Last effective flowers occur at "cutout." Cutout was determined by measuring node above white flower (NAWF) until NAWF=5. NAWF=5 + 350 HU was validated as a useful rule for use in terminating most boll feeding insect control.

Information is needed on boll susceptibility to tarnished plant bug injury. Experiments were conducted in 1997 and 1998 to determine effect of boll age (measured in HU accumulation after anthesis) on susceptibility to tarnished plant bug injury.

Materials and Methods

Two cotton varieties were studied: NuCotn 33B (a transgenic Bt variety) and Deltapine 50 (a conventional variety). Cotton was planted on May 7 in both 1997 and 1998 and grown under normal agricultural practices. Treatments consisted of allowing bolls to grow in the field until they accumulated a specified number of heat units from the day of anthesis. Treatments were the following boll ages expressed as HU accumulation after anthesis: (1) 50 HU, (2) 100 HU, (3) 150 HU, (4) 200 HU, (50) 250 HU, (6) 300 HU, (7) 350 HU, (8) 400HU, (9) 450 HU, and (10) 500 HU. Heat units varied as much as 33 HU from the specified heat unit treatment and the average deviation was 12.2 HU (Table 1).

Unsexed tarnished plant bug adults, two per boll, were caged in the field on each of 10 bolls per replication on the day the specified age was reached for each of the boll age treatments (except in the 1997 replication only 5 bolls per treatment were used). Cages were constructed of 6-fl-oz styrofoam cups. One hole on each side and one hole in the bottom of each cup provided ventilation. Holes were 0.5 inch diameter and covered with nylon mesh (ca. 1 mm mesh). A cut was made on the lid to the center straw hole in order to place the lid on the peduncle. Weather strip caulking material was used to secure the cup lid to the peduncle. Clear Scotch® tape was used to seal the cut and to secure the cup to the lid.

One replication of the experiment was conducted in the summer of 1997. Four replications were conducted in the summer of 1998. One hundred white blooms were tagged on July 21 in each variety in 1997. Two hundred white blooms were tagged in each variety for each replication in 1998. Blooms were tagged on Monday and Wednesday for two weeks starting on Monday, June 29. Bolls were infested for 48 hours. Replications were non-randomized blocks and treatments within blocks were temporally separated due to different times required to reach different specified boll ages.

Daily heat units were calculated from the date the blooms were tagged using the daily heat unit formula: HU = (Max °F + Min °F)/2 – 60°F. Daily maximum and minimum

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temperatures were taken from the Delta Research and Extension Center weather station located at Stoneville, MS.

Bolls were removed from the field after the infestation period and examined for punctures and feeding injury. Punctures were counted and rated on a scale from one to three according to depth of penetration as follows: 1 = ectoderm penetrated, 2 = mesoderm penetrated, and 3 = endoderm penetrated. Average punctures per boll, average depth of penetration, and average injury rating (no. punctures/boll * average depth of penetration) were statistically analyzed by analysis of variance and mean differences were tested by Duncan's New Multiple Range Test (P=0.05).

Results and Discussion

Data are summarized in Tables 2 - 4 as mean number of punctures per boll, mean depth of penetration per boll, and mean injury rating per boll. The means show a distinct and statistically significant difference, in most cases, between bolls aged 200 HU and 250 HU in both varieties tested. Means of the measurements (ratings) on injury approach zero at bolls aged 250 HU in all cases. Mean injury measurements and ratings for bolls aged 250 – 500 HU were significantly lower than for bolls aged 50 – 200 HU, in most cases. Means for bolls aged 300 – 500 HU were significantly lower than for bolls aged 50 – 200 HU in all cases.

Conclusion

These results indicate that bolls that have accumulated 250 HU after anthesis are relatively safe from tarnished plant bug attack. Some data suggest that 300 HU accumulated after anthesis is a more appropriate, conservative estimate of when bolls are safe from tarnished plant bug attack. Therefore, the results of this study support a rule for terminating tarnished plant bug control in cotton at NAWF = 5 + 300 HU.

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Table 1. Projected boll age for each treatment, actual mean boll age attained, and range of actual boll ages attained for each treatment; boll ages expressed in HU accumulated after anthesis.

Boll Age Projected	Boll Age Actual Mean	Boll Age Actual Range
50	51.4	44 – 57
100	104	96 – 115
150	153.2	140 – 169
200	200.6	188 – 212
250	250	237 – 265
300	297.6	291 – 310
350	340.6	332 – 354
400	382	367 – 389
450	432	431 – 437
500	477	472 – 482

Table 2. Average number of punctures per boll.

Boll Age	NuCotn 33B	Deltapine 50
50 HU	1.72ab	1.43ab
100 HU	2.24a	1.84a
150 HU	1.46b	1.44ab
200 HU	1.56b	1.18b
250 HU	0.44c	0.62c
300 HU	0.34c	0.24cd
350 HU	0.26c	0.28cd
400 HU	0.12c	0.18cd
450 HU	0.08c	0.12cd
500 HU	0.02c	0.00d

Means followed by the same letter do not significantly differ according to Duncan's New Multiple range Test (P=.05).

Table 3. Average depth of penetration per boll.[1/]

Boll Age	NuCotn 33B	Deltapine 50
50 HU	1.25a	1.22a
100 HU	1.19ab	1.14a
150 HU	0.90bc	0.93b
200 HU	0.77c	0.64c
250 HU	0.32d	0.39d
300 HU	0.25d	0.22de
350 HU	0.22d	0.20def
400 HU	0.10d	0.16ef
450 HU	0.08d	0.12ef
500 HU	0.02d	0.00f

Means followed by the same letter do not significantly differ according to Duncan's New Multiple Range Test (P=.05).

[1/]Depth of penetration rating: 1 = ectoderm penetrated, 2 = mesoderm penetrated; 3 = endoderm penetrated.

Table 4. Average injury rating for each variety.[1/]

Boll Age	NuCotn 33B	Deltapine 50
50 HU	2.95ab	2.69ab
100 HU	3.52a	2.84a
150 HU	2.18bc	1.96bc
200 HU	1.86c	1.48cd
250 HU	0.42d	0.68de
300 HU	0.38d	0.22e
350 HU	0.26d	0.28e
400 HU	0.12d	0.22e
450 HU	0.08d	0.12e
500 HU	0.02d	0.00e

Means followed by the same letter do not significantly differ according to Duncan's New Multiple Range Test (P=.05).

[1/]Injury rating = (no. punctures/boll)*(mean depth of penetration/boll).