MANAGEMENT DECISIONS FOR STINK BUGS

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Abstract

Because stink bugs can be difficult to detect in cotton with traditional sampling tools, we examined other methods of monitoring the pest complex for management decisions. Trapping stink bugs in pheromone traps could prove useful in making timely management decisions concerning their control in cotton. The brown stink bug (BSB), *Euschistus servus* (Say), and *Euschistus* spp. were successfully lured and captured during the 2000 season, but potential for successful pheromone trapping of stink bugs remains contingent upon development of lures for other important species. Action thresholds for stink bugs, based on monitoring internal boll damage caused by their feeding, were tested, and treatment at 20% injury to 14-d-old bolls adequately protected yields. The ability of bugs to damage cotton decreased as bolls aged, and 25-d-old bolls were not significantly damaged in terms of yield. Feeding by large immature stages (3^{rd}-5^{th} instars) and adults of the southern green stink bug (SGSB), *Nezara viridula* (L.), on individual, half-grown bolls caused significant yield loss. In laboratory bioassays, dicrotophos (Bidrin), a standard organophosphate used for control of bug pests, provided excellent control (96-100% mortality) of laboratory-reared 5^{th} instars and field-collected adults of SGSB and BSB, remained efficacious at a reduced rate of 0.25 lb [AI]/A (4 oz/A), and is relatively inexpensive. Zetacypermethrin (Fury), cypermenthrin (Ammo), bifenthrin (Capture),and cyfluthrin (Baythroid), standard pyrethroids used for control of worm pests, provided good/excellent control of SGSB but poor/fair control of BSB, confirming field reports of pyrethroid failures with control of BSB. Comparatively, Capture and Orthene were more effective on BSB than on SGSB and could be alternatives to Bidrin in controlling this species if necessary. Some of the emerging materials that target lepidopterous insects demonstrated minimal suppression of pentatomids. Indoxacarb (Steward), emamectin benzoate (Denim), and spinosad (Tracer) did not offer substantial control of field-collected adults of either SGSB or BSB, but Denim appeared to have limited activity against laboratory-reared 5^{th} instars of both species.

Introduction

In Georgia and in many areas of the cotton belt, successful eradication of the boll weevil, expanding use of transgenic *Bt* cotton, and advances in lepidopteran-specific insecticide chemistry have all contributed to a changing pest complex in cotton. The bottom line, concerning these changes and the increased importance of stink bugs, is the reduction of broad-spectrum insecticide use for other pests and the opportunity for stink bugs to avoid coincidental control.

The most important species of Pentatomidae in Georgia cotton are the green stink bug, *Acrosternum hilare* (Say), the southern green stink bug, *Nezara viridula* (L.), and the brown stink bug, *Euschistus servus* (Say). These phytophagous species and others damage cotton with their piercing/sucking mouthparts by injecting digestive enzymes and feeding on developing seeds within bolls (Wene and Sheets 1964). This process allows entry of microorganisms that also contribute to physiological damage and degradation of fruit (Watkins 1981, Verma 1986), resulting in reduced yield and lint/seed quality. Stink bugs leave evidence of their feeding in and on bolls that is easily recognized and quantified. Symptoms of internal feeding damage are intimately related to yield and fiber quality and can be useful as predictors of damaging populations of stink bugs. Affected bolls reveal damage to lint, seeds, and carpel walls when examined internally for feeding injury. Our previous work has demonstrated that damage symptoms can appear within 24-48 hr after feeding and that bolls aged ca. 14 d from white bloom are an appropriate size for examination (Greene and Herzog 1999a,b). We have also reported that as *N. viridula* and bolls age, damage potential increases and decreases, respectively (Greene et al. 1999).

Organophosphorus insecticides such as dicrotophos (Bidrin) and methyl parathion provide excellent control of stink bugs in cotton. Pyrethroid insecticides will also offer control (apparently differing between species) and are useful when populations of lepidopterous pests and stink bugs are present concurrently. However, the key to successful management of stink bugs in cotton is to apply these materials at the appropriate time and pest density (i.e. threshold). In general, timely intervention with insecticides is based on detection of target organisms in the field. However, traditional sampling methods (Todd and Herzog 1980) used for locating stink bugs in cotton (drop cloth, sweep net, and observational counts) can be inefficient, time consuming, destructive to developing fruit, and produce variable results. Despite sampling difficulties, a research-based treatment threshold (Greene et al. 1998, Greene et al. 2001) of 1 stink bug per 6 ft (2 m) of row using a ground cloth has been adopted by most states in the Southeast. Because stink bugs are frequently difficult to detect, we initiated research several years ago to develop a threshold based on symptoms of bug feeding damage to bolls. Because of this work, our recommendations for stink bug management have been appended to include a threshold for treatment based on a percentage of bolls internally damaged by stink bugs (when 20% of medium-sized [ca. 2-wk-old] bolls have at least one internal feeding symptom [wart-like growth or stained lint/seed associated with puncture] per boll.) (Greene and Herzog 2000c). Other states now recommend treatment for stink bugs using a damage threshold.

In 2000, we continued investigations into the effectiveness of treating for stink bugs when percentages of a particular age group of bolls displayed feeding damage exceeding predetermined levels. Results were combined with those obtained in 1999 (Greene and Herzog 2000c) to demonstrate the value of using the threshold on various fields over time. Also, we compared, in laboratory bioassays, the effects of several new chemistries with those of established materials on mortality of two important species, the southern green stink bug (SGSB), *Nezara viridula* (L.), and the brown stink bug (BSB), *Euschistus servus* (Say). Also, we addressed the age of stink bugs and bolls again during 2000. Finally, we reexamined the effectiveness of using a pheromone trap and lure combination to observe populations of stink bugs around cotton fields.

Materials and Methods

Cage Experiments

A laboratory colony of *N. viridula*, regularly supplemented with adults and late instars collected from soybeans, cotton, and millet, was held in an environmental chamber at 27°C, 60% RH, and a photoperiod of 14:10 (L:D) h, and fed a diet of green beans and raw, shelled peanuts. This rearing procedure was a variation of methods described previously (Harris and Todd 1981).

Insect cages (19, each 6 x 6 x 12 ft), constructed using 18 x 14 mesh screen and aluminum pipe frames, were placed over cotton (NuCOTN33b) during 19-23 June 2000 near the Coastal Plain Experiment Station in Tifton, GA.

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On 26 and 29 June, bifenthrin (Capture 2EC at 0.05 lb [ai]/a) was applied to caged plants, using a compressed-air backpack sprayer that delivered 12.5 gal/a at 50 psi, to kill arthropods present. White blooms on enclosed cotton were tagged with fluorescent flagging tape every 2 or 3 d and dated. Small cages, designed to enclose a single boll, were constructed of 12 oz polystyrene foam cups, knee-high nylon hose, rubber bands, and wire ties. Bottoms of cups and toe-ends of nylon hose were removed, and cups were placed in the middle of the hose sleeves. The bottom end of a cup cage was placed over a boll to enclose it, and the sleeve was tied with a wire tie to the peduncle of the boll. An experiment was initiated by placing a single stink bug inside a cup with the boll, folding the other end of the sleeve over the top of the cup and securing it with a rubber band. Dead bugs were removed from cages and replaced daily.

In the first experiment, we addressed the extent of yield loss caused by various life stages of *N. viridula* (L.). We confined individual 2nd, 3rd, 4th, and 5th instars and adults singly in cages (Greene et al. 1999) with 10-d-old bolls using a completely randomized design with 72 replications per treatment. Seventy-two bolls of similar age were caged without bugs as controls. After a 3.5-d exposure, bugs were removed from the cages. At maturity, cotton was manually harvested and weighed from each boll.

In the second experiment, we determined the effect of boll age on stink bug feeding and yield loss by confining 5th instars of *N. viridula* singly with bolls aged 4, 8, 10, 14, 18, 21, 25, and 30 d from white bloom, using a design similar to the previous experiment. Bugs were removed after 7 d and cotton harvested at maturity.

Pheromone Trapping

Thirty-four traps, modified from Mizell and Tedders (1995), were placed in and around three cotton fields near Tifton, GA, on 26 June 2000. Major components of the traps were corrugated plastic, insect wire screen, rubber septa, and synthetic pheromone. Trap tops were made from wire screening material, and trap bases were made from sheets of 10-mm corrugated plastic board (4' x 8' safety yellow). Lures were placed in the wire-screen top of each trap and consisted of a rubber septum (sleeve stopper, Fisher Scientific) treated with 40 µl of methyl 2,4-decadienoate (Bedoukian Research), and replaced every 3-4 d. In additional tests, other top designs were found to be more efficient, but the original screen tops and bases were used in this study. Traps were examined and emptied twice per wk and removed from fields on 3 November 2000.

Insecticide Efficacy

Laboratory colonies of the southern green stink bug, *N. viridula*, and the brown stink bug, *E. servus*, were established and maintained using procedures described previously. Laboratory-reared 5th instars and field-collected adults of *N. viridula* or of *E. servus* were placed singly in 30-ml plastic diet cups with a 3-4 cm section of green bean before topical assays.

Doses of each insecticide used in the laboratory studies simulated the concentrations of field-use rates applied at a total volume of 10 gal/a. Mixtures using 1 ml of material were made for the following insecticides and field-use rates: dicrotophos (Bidrin 8, Amvac, Los Angeles, CA, 0.25 and 0.50 lb [AI]/A), cyfluthrin (Baythroid 2, Bayer, Kansas City, MO, 0.033 lb [AI]/A), spinosad (Tracer 4, Dow AgroSciences, Indianapolis, IN, 0.067 lb [AI]/A), indoxacarb (Steward 1.25, DuPont, Wilmington, DE, 0.11 lb [AI]/A), emamectin benzoate (Denim 0.16, Novartis, Greensboro, NC, 0.0125 lb [AI]/A), zetacypermethrin (Fury 1.5, FMC, Philadelphia, PA, 0.0375 lb [AI]/A), bifenthrin (Capture, FMC, 0.05 lb [AI]/A), cypermethrin (Ammo 2.5, FMC, 0.06 lb [AI]/A) imidacloprid (Provado 1.6, Bayer, 0.047 lb [AI]/A), imidacloprid/cyfluthrin (Leverage 2.7, Bayer, 0.0634 lb [AI]/A), and acephate (Orthene 90S, Valent, Walnut Creek, CA, 0.5 lb [AI]/A). To simulate practical efficacy in the field, 1 µl of each insecticide mixture (or water as a control) was applied to the ventral abdominal segments of each insect. Each bug was returned to its respective diet cup following treatment. A bug was considered dead if in a supine position and no coordinated movement was observed after agitating its cup, and mortality was recorded 24, 48, 72, and 96 hr after treatment.

Injury Thresholds

Plots of NuCOTN33B at the Coastal Plain Experiment Station in Tift County, GA (16 rows by 50 ft, 1999 and 2000) and the Attapulgus Research Center in Decatur County, GA (24 rows by 130 ft, 1999; 20 rows by 80 ft, 2000) and DP655B/RR at a producer's farm in Brooks County, GA (48 rows by 150 ft, 1999) were arranged in a RCBD with 6-7 treatments and 4 replications. At another producer's farm in Irwin County, GA, strip plots of NuCOTN35B (dryland) or DP451B/RR (irrigated) were arranged with 3 replications and 2 treatments: 1) treated with pyrethroid at threshold and 2) untreated.

Twenty-five bolls (50-75% full size, ca. 14 d from white bloom) were collected from each plot weekly and examined for internal symptoms (cell proliferation) of feeding by stink bugs. A boll was considered damaged if at least one internal growth was observed. In Tift, Decatur, and Brooks Counties, dicrotophos (Bidrin 8, Amvac, Los Angeles, CA at 0.50 lb [AI]/a) was applied to all plots in a treatment at or exceeding the following levels of damaged bolls: 10, 20, and 30% and at a density of 1 bug per 6 ft of row. Additional treatments included cyfluthrin (Baythroid 2, Bayer, Kansas City, MO at 0.04 lb [AI]/a) or cyhalothrin (KarateZ 2.08, Zeneca, Wilmington, DE at 0.03 lb [AI]/a) applied weekly at Attapulgus and Tifton, respectively, and an untreated control at all sites. In Irwin County, a single application of either cyhalothrin or zetacypermethrin was applied using 20% internal damage as a threshold. Two or four rows from the center of each plot were harvested by machine.

Results and Discussion

Cage Experiments

As bugs aged, damage increased and yields decreased (Figure 1). Large instars (3rd - 5th) and adults of *N. viridula* caused significant yield loss. These results were identical to previous results (Greene and Herzog 2000a), with the exception that adults caused more damage than 5th instars. These and our earlier findings concerning damage potential of immature life stages demonstrate the importance of controlling reproducing populations of stink bugs in cotton.

As bolls aged, damage and yield loss decreased (Figure 2). Significant yield loss did not occur with bolls aged 25 or 30 d from white bloom that had accumulated over 559 heat units (HU). In our earlier findings (Greene and Herzog 2000a), bolls aged 21 d with over 405 HU accumulated did not suffer significant yield reduction. These results were similar to even earlier findings where bolls aged 18 d with over 380 HU did not display significant symptoms of feeding damage (Greene et al. 1999). Results were obtained from cotton under field cages that provided ca. 18% shade to enclosed plants and with laboratory-reared stink bugs confined to single bolls for an entire week. Considering the effects of shading and exposure length, bolls are likely safe from significant yield loss due to stink bugs when they attain an age of 21-25 d from white bloom (ca. 3 wk old) and/or an accumulation of 450-550 HU. Because bolls would likely increase in size and mature faster with full canopy exposure to photo synthetic energy and because of the artificially-intimate and intense exposure to stink bugs in the enclosures, this should be a conservative estimate. However, potential differences between feeding abilities of laboratory-reared and field-collected insects were not addressed. Because bolls apparently become resistant to bug feeding and damage as they age, we should be better able to decide when to terminate insecticide use for stink bugs based on these results.

Pheromone Trapping

Over a 19-wk sampling period, 2208 stink bugs were captured in 34 traps. Approximately 93% of those trapped were part of the brown stink bug

complex, *Euschistus* spp. The majority of which were *E. servus* (90%), with some *E. tristigmus* (3%). Others included the green stink bug, *A. hilare* (4%), the southern green stink bug, *N. viridula* (2%), and miscellaneous species (1%).

Weekly trap numbers appeared to reflect field populations, at least during August (Figure 3). During the second wk in August, trap capture increased after a steady decline during late June and throughout July. On 25 August, threshold levels (at least 1 bug per 2 m of row) of stink bugs were detected with shake-cloth procedures. This occurred ca. 2 wk after a noticeable shift in trap capture - increased catch compared with the previous wk. Bolls matured, hardened, and opened during September, and trap catch declined until the end of the month. Defoliation near the end of September and beginning of October apparently triggered an emigration of stink bugs seeking more suitable hosts because trap captures increased in response. The pattern of trap capture for 2000 resembled that observed in 1999 (Greene et al. 2000).

Although the traps were successful in capturing brown stink bugs, the availability of operative lures for other important species such *N. viridula* would have undoubtedly increased capture and monitoring capacity. Our research methods and data, based on trap capture of brown stink bugs alone, are useful but will be more valuable when additional "field-ready" lures become available for other important species of Pentatomidae.

Insecticide Efficacy

Dicrotophos (Bidrin) provided excellent control (97-100% mortality) of both lab-reared 5th instars (Table 1) and field-collected adults (Table 2) of the southern green stink bug, *N. viridula*, at either 0.25 or 0.50 lb [AI]/A. The pyrethroids provided good control (77-98%) of SGSB 24 hr after treatment. Lep-specific materials (Tracer, Denim, Steward) offered little or no control of adults (Table 2) but some mortality (11-37%) of 5th instars (Table 1) after 24 hr. Of those materials, Denim had the most activity on immature SGSB as mortality reached 64% by 72 hr after treatment. Cumulative mortalities for several treatments fluctuated slightly and, in some cases, decreased over time because some SGSB recorded as dead apparently recovered from initial "knockdown". These results were consistent with those found previously concerning SGSB (Greene and Herzog 2000b).

Bidrin provided excellent control (96-100% mortality) of both 5th instars (Table 3) and adults (Table 4) of the brown stink bug, *E. servus*, at both rates. However, in contrast with control of SGSB, the pyrethroids provided poor/fair control (20-65%) of BSB after 24 hr. Mortality of adult BSB was higher in the Capture treatment (65%) compared with the other pyrethroids (20-28% mortality) at 24 hr (Table 4). Lep-specific materials (Tracer, Denim, Steward) provided little or no control of BSB, except for Denim on 5th instars that gave from 44% (24 hr) to 83% (96 hr) mortality (Table 3).

Injury Thresholds

Because of the difficulties in detecting stink bugs in cotton, we tested the effectiveness of using symptoms of boll injury as a monitoring tool for treatment decisions. In Tift, Decatur, and Brooks Counties, highest yields were obtained in plots that received 2 applications of dicrotophos (Bidrin 8) at 20% internal boll injury (Figure 4). Lint yields from plots protected at 20% exceeded those in untreated plots by over 100 lb and resulted in the highest net economic gain. Plots treated over 4 times at 10% injury produced similar yields, but with the expense of 2 additional applications. These applications, administered at a lower threshold, apparently were unnecessary, resulting in reduced monetary gains. Plots receiving less than 1 application (on average), timed for 30% injury, produced intermediate results. One application at our threshold based on a bug density (1 bug/2 m of row) did not result in significant yield increases. Because plants were exceedingly tall at several sites, bugs were difficult to detect in the elevated canopies using the drop-cloth technique. This could have resulted in undetected densities exceeding threshold, fewer insecticide applications, more boll damage, and reduced yields.

Testing of our damage threshold (20%) at a producer's farm provided a "real-world" test of our approach. At an irrigated field in Irwin County, 1 application of cyhalothrin (Karate), after detecting 18% internal boll damage, resulted in reduced boll injury for much of August (Figure 5). Damage levels in untreated plots exceeded 70%, compared with 8% in treated plots during mid-August. An additional 122 lb of lint were obtained in treated plots at the irrigated field. At the dryland test (Figure 6), an application of zetacypermethrin (Fury) was applied late (40% injury) but reduced damage levels and increased yields by over 50 lb. As a result of these continuing studies, alternative monitoring and management recommendations are available for stink bugs in cotton.

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Table 1. Cumulative mortality of lab-reared 5th instars of *Nezara viridula* over a 4-d interval, following exposure[1] to insecticides in laboratory bioassays (125 reps/trt).

	Field Rate/A	$/A/	% Cumulative Mortality			
Treatment	lb AI/A (oz/A)	appl	24 hr	48 hr	72 hr	96 hr
Control	N/A	N/A	5	9	10	12
Fury	0.0375 (3.2)	$5.38	98	97	95	95
Ammo	0.06 (3.07)	$3.24	96	97	94	94
Capture	0.05 (3.2)	$9.25	77	74	78	78
Baythroid	0.033 (2.1)	$5.45	87	90	88	90
Leverage	0.0634 (3.0)	$9.78	96	93	91	93
Provado	0.047 (3.76)	$13.37	79	78	76	75
Bidrin	0.5 (8)	$5.31	100	100	100	100
Tracer	0.067 (2.14)	$12.14	22	23	26	29
Denim[2]	0.0125 (10)	N/A	37	53	64	64
Steward	0.11 (11.26)	N/A	11	14	20	22
Orthene[3]	0.5 lb (0.56) lb)	$4.72	76	90	94	94
Bidrin[4]	0.25 (4)	$2.66	99	99	99	99

[1] Application of 1-µl to ventral abdominal segments
[2] 113 replications
[3] 80 replications
[4] 135 replications

Table 2. Cumulative mortality of field-collected adults of *Nezara viridula* over a 4-d interval, following exposure[1] to insecticides in laboratory bioassays (177 reps/trt).

	Field Rate/A	$/A/	% Cumulative Mortality			
Treatment	lb AI/A (oz/A)	appl	24 hr	48 hr	72 hr	96 hr
Control	N/A	N/A	3	6	12	23
Fury	0.0375 (3.2)	$5.38	92	94	95	97
Ammo	0.06 (3.07)	$3.24	86	92	92	93
Capture	0.05 (3.2)	$9.25	83	83	82	83
Baythroid	0.033 (2.1)	$5.45	87	92	91	93
Leverage	0.0634 (3.0)	$9.78	93	89	87	89
Provado	0.047 (3.76)	$13.37	46	46	49	53
Bidrin	0.5 (8)	$5.31	97	97	98	99
Tracer	0.067 (2.14)	$12.14	2	5	12	24
Denim	0.0125 (10)	N/A	6	16	32	42
Steward	0.11 (11.26)	N/A	8	19	24	35
Orthene[2]	0.5 lb (0.56 lb)	$4.72	48	62	69	73
Bidrin[3]	0.25 (4)	$2.66	97	97	97	97

[1] Application of 1-µl to ventral abdominal segments
[2] 124 replications
[3] 70 replications

Table 3. Cumulative mortality of lab-reared 5th instars of *Euschistus servus* over a 4-d interval, following exposure[1] to insecticides in laboratory bioassays (24 reps/trt).

	Field Rate/A	$/A/	% Cumulative Mortality			
Treatment	lb AI/A (oz/A)	appl	24 hr	48 hr	72 hr	96 hr
Control	N/A	N/A	4	8	8	8
Fury	0.0375 (3.2)	$5.38	63	54	58	63
Ammo	0.06 (3.07)	$3.24	38	42	42	46
Capture	0.05 (3.2)	$9.25	63	67	67	63
Baythroid	0.033 (2.1)	$5.45	63	58	54	63
Leverage	0.0634 (3.0)	$9.78	79	71	63	68
Provado	0.047 (3.76)	$13.37	63	67	58	58
Bidrin	0.5 (8)	$5.31	96	96	96	96
Tracer	0.067 (2.14)	$12.14	8	21	25	29
Denim[2]	0.0125 (10)	N/A	44	56	78	83
Steward	0.11 (11.26)	N/A	13	17	29	42
Orthene[3]	0.5 lb (0.56 lb)	$4.72	100	100	100	100

[1] Application of 1-µl to ventral abdominal segments
[2] 18 replications
[3] 6 replications

Table 4. Cumulative mortality of field-collected adults of *Euschistus servus* over a 4-d interval, following exposure[1] to insecticides in laboratory bioassays (81 reps/trt).

	Field Rate/A	$/A/	% Cumulative Mortality			
Treatment	lb AI/A (oz/A)	appl	24 hr	48 hr	72 hr	96 hr
Control	N/A	N/A	1	3	4	5
Fury	0.0375 (3.2)	$5.38	28	33	33	37
Ammo	0.06 (3.07)	$3.24	20	21	22	26
Capture	0.05 (3.2)	$9.25	65	64	59	61
Baythroid	0.033 (2.1)	$5.45	24	31	30	30
Leverage	0.0634 (3.0)	$9.78	47	43	44	42
Provado	0.047 (3.76)	$13.37	28	26	21	21
Bidrin	0.5 (8)	$5.31	96	96	98	98
Tracer	0.067 (2.14)	$12.14	6	7	14	17
Denim[2]	0.0125 (10)	N/A	5	5	11	11
Steward	0.11 (11.26)	N/A	1	9	11	14
Orthene[3]	0.5 lb (0.56 lb)	$4.72	69	86	94	94
Bidrin[4]	0.25 (4)	$2.66	100	100	100	100

[1] Application of 1-µl to ventral abdominal segments
[2] 63 replications
[3] 35 replications
[4] 38 replications

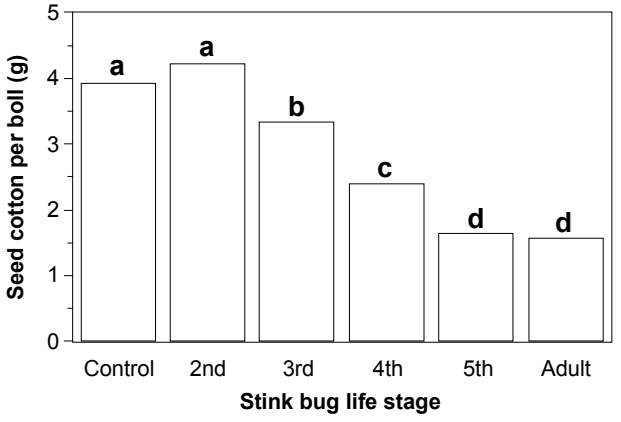

Figure 1. Yield following 3.5 d exposure of 10-d-old bolls to *Nezara viridula*, 72 reps/trt. Treatment bars with a letter in common are not significantly different, LSD, $P < 0.05$.

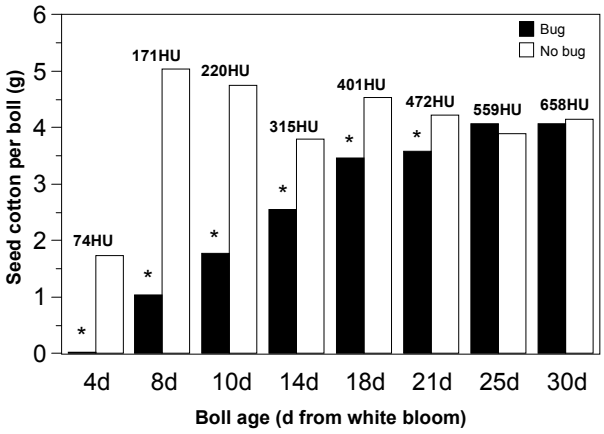

Figure 2. Yield following 1 wk exposure of bolls of different ages to 5th instars of *Nezara viridula*, 46 reps / age group (23 with and without bugs), *Significant difference, $P < 0.05$. HU, heat units (calculated by summing average daily temperature F° – 60 for each d).

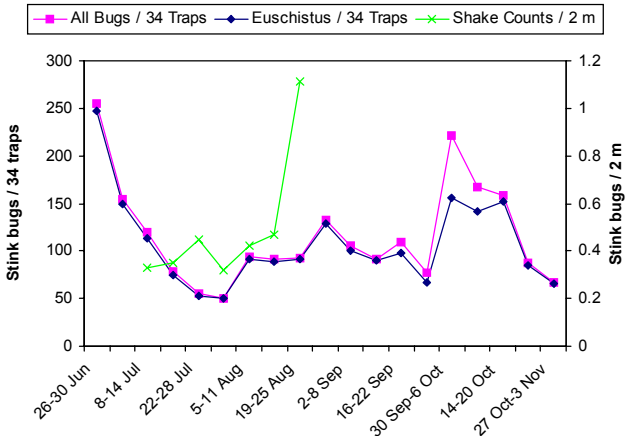

Figure 3. Weekly capture of all stink bug species and the brown stink bug complex, *Euschistus* spp, in pheromone-baited traps over a 19-wk interval. Shake-cloth samples for all species over a 7-wk interval.

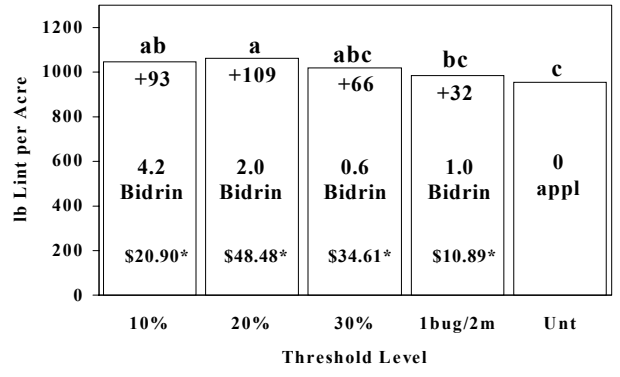

Figure 4. Five-site average (1999 and 2000) lint yield following treatment with dicrotophos (Bidrin 8, avg. # of treatments per season) at various thresholds (percentage of internal boll injury or density) for stink bugs. *Net $ gain, calculated with yield gain at $0.60 per lb minus $8.31 per application ($5.31, insecticide plus $3.00, application costs). Treatment bars with a letter in common are not significantly different, P > 0.05, LSD = 77.

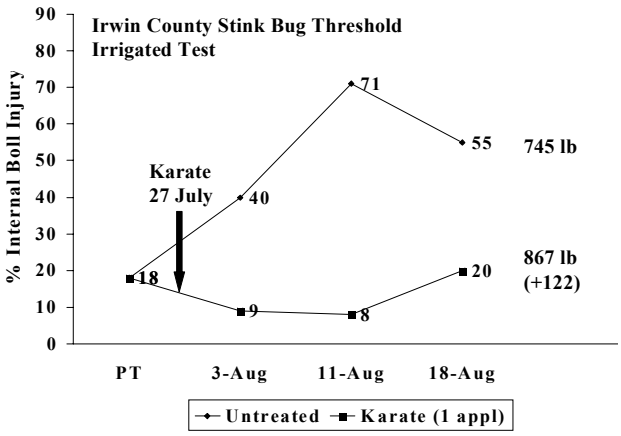

Figure 5. Internal boll injury caused by stink bugs and lint yields from untreated and treated (cyhalothrin, Karate) plots of irrigated cotton in Irwin County, Georgia (2000).

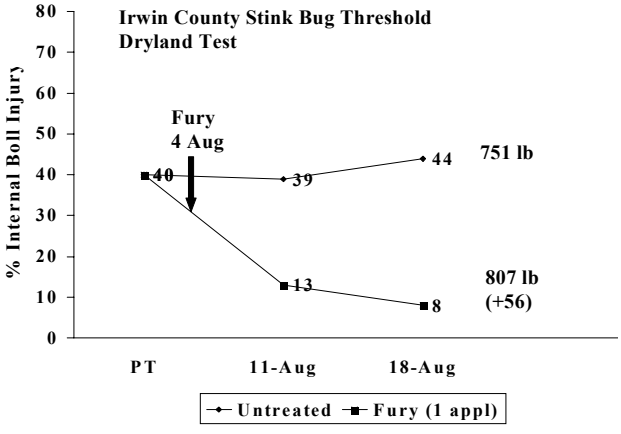

Figure 6. Internal boll injury caused by stink bugs and lint yields from untreated and treated (zetacypermethrin, Fury) plots of dryland cotton in Irwin County, Georgia (2000).