2005 Beltwide Cotton Conferences, New Orleans, Louisiana - January 4 - 7, 2005

MANAGEMENT CONSIDERATIONS FOR STINK BUGS - 2004

Jeremy Greene and Chuck Capps
University of Arkansas
Monticello, AR
Gus Lorenz
University of Arkansas
Little Rock, AR
Glenn Studebaker
University of Arkansas
Keiser, AR
John Smith and Randy Luttrell
University of Arkansas
Fayetteville, AR
Steve Kelley and Wes Kirkpatrick
University of Arkansas
McGehee, AR

Abstract

Because stink bugs continue to pose a challenge to current and future efforts concerning cotton insect management, we continued investigations into alternative monitoring strategies and management tactics for the pest complex. Pheromone trapping of stink bugs was again difficult, due primarily to reduced availability and considerable expense of currently available lures. Also, unavailability of lures for other important species continues to make potential pheromone trapping prohibitive. Research with treatment thresholds for stink bugs, based on monitoring internal feeding injury to bolls, continued to support treatment at the 10-20% injury to mid-sized (ca. 14-d-old) bolls. In laboratory bioassays concerning insecticide efficacy (1999-2004), methyl parathion (Methyl 4E) and dicrotophos (Bidrin 8), standard organophosphates used for control of bug pests, provided superior control (95-100% mortality) of field-collected fifth instars and adults of the green stink bug (GSB), *Acrosternum hilare* (Say), the brown stink bug (BSB), *Euschistus servus* (Say), and the southern green stink bug (SGSB), *Nezara viridula* (L.), at 0.5 lb (AI)/A. Pyrethroid insecticides alone provided variable results (48-92% 24-hr mortality) due to considerable tolerance by BSB. In caging experiments, the ability of GSB to damage cotton bolls and reduce yield decreased as bolls aged, and yields from bolls that accumulated 558 HU at 26 d following anthesis were not significantly reduced.

Introduction

There are several issues related to insect management in cotton that have the potential to greatly impact profitability for many producers. One of the most significant issues concerns shifts in insect pest status. The stink bug complex is an excellent example of a pest group that has shifted in importance and continues to draw attention. Stink bug management has increased in importance in many major crops, including cotton, soybeans and rice. Predominant phytophagous (plant-feeding) stink bugs in cotton in the Southeast and much of the Mid-South are similar and include the green stink bug (GSB), *Acrosternum hilare* (Say), the southern green stink bug (SGSB), *Nezara viridula* (L.), and the brown stink bug (BSB), *Euschistus servus* (Say). Several other species are part of the plant-feeding stink bug complex but are of less importance. In cotton with limited broad-spectrum insecticide use for tobacco budworm, *Heliothis virescens*, and bollworm, *Helicoverpa zea*, (i.e., *Bt* cotton) and in areas with significantly reduced insecticide use for control of boll weevil, *Anthonomus grandis*, severe infestations of stink bugs can develop and cause considerable losses to yield and fiber quality. High amounts of stink bug damage to developing bolls can result in yield losses exceeding hundreds of pounds per acre and price reductions due to inferior lint quality. Economic thresholds for stink bugs need to be updated in changing production systems and producers educated on biology and control. Further development and validation of monitoring methods, thresholds and control strategies for stink bugs in cotton will facilitate the implementation of recommendations concerning their management in the future. Studies to date have indicated that a treatment threshold of one stink bug per six row feet and/or 20% internal injury to medium-sized bolls is appropriate for cotton in the Southeast (Greene et al. 2001b), where stink bugs have become primary pests in *Bt* cotton. In the Mid-South, where plant bugs (predominantly *Lygus lineolaris*) are also a major part of the boll-feeding bug complex, treatment essentially is required more often (10-20%). These thresholds continue to need refinement and validation to aid cotton producers in an ever-changing environment. In addition to the need for development and validation of thresholds for stink bug control in cotton, we continually need information concerning the efficacy of insecticides currently and potentially available for cotton insect control. Many important species have developed tolerance to commonly used insecticides and availability of alternative chemistries is important to the future management of stink bugs. Entomologists have been addressing these problems for several years now and have generated some useful information concerning management of stink bugs in cotton (Greene et al. 1999; Greene et al. 2001a,b; Willrich et al. 2002, 2003; Greene and Capps 2002, 2003). In 2004, we continued investigations, in laboratory bioassays, into the effects of several new chemistries with those of established materials on mortality of these important species. We also continued work with pheromone trapping and development of boll-injury-based thresholds for stink bugs. The ability of GSB to injure bolls of varying ages was addressed in cage experiments to investigate the duration of susceptibility to bug injury.

Materials and Methods

Insecticide Efficacy

Adults and nymphs of GSB, SGSB, and BSB were collected from soybeans with a sweep net and held overnight in an environmental chamber at 27°C, 60% RH, and a photoperiod of 14:10 (L:D) h. They were provided with water and green beans (Harris and Todd 1981), and the following day, adults and fifth instars of each species 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 simulated the concentrations of field-use rates applied at a total volume of 10 gal per acre (Greene and Capps 2002, 2003). Mixtures using 1 ml or 1 g 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/imidacloprid (Leverage 2.7, Bayer, Kansas City, MO, 0.07 and 0.079 lb [AI]/A), cyfluthrin (Baythroid 2EC, Bayer, 0.03 and 0.033 lb [AI]/A and Baythroid XL, Bayer, 0.015 and 0.018 lb [AI]/A), spinosad (Tracer 4, Dow AgroSciences, Indianapolis, IN, 0.067 and 0.07 lb [AI]/A), *lamda*-cyhalothrin (Karate 2.08CS, Syngenta, Greensboro, NC, 0.02, 0.025 and 0.03 lb [AI]/A), *zeta*-cypermethrin (Mustang Max 0.8, FMC, Philadelphia, PA, 0.018, 0.02 and 0.022 lb [AI]/A and Fury 1.5EC, FMC, 0.0375 and 0.0445 lb [AI]/A), imidacloprid (Trimax 4, Bayer, 0.03125 and 0.0469 lb [AI]/A), oxamyl (Vydate 3.77, DuPont, Wilmington, DE, 0.25 and 0.33 lb [AI]/A), methyl parathion (Methyl 4E, Cheminova, Wayne, NJ, 0.25, 0.5, and 1.0 lb [AI]/A), CS-AU-44-JO (Control Solutions, Pasadena, TX, 1 qt/acre), novaluron (Diamond 0.83EC, Crompton/Uniroyal, Middlebury, CT, 0.039 and 0.08 lb [AI]/A), thiamethoxam (Centric 40WG, Syngenta, 0.03125 and 0.05 lb [AI]/A), chlorpyrifos (Lorsban 4E, Dow AgroSciences, 0.5 lb [AI]/A), Prolex 1.25 (Dow AgroSciences, 0.015 lb [AI]/A), acephate (Orthene 97, Valent, Walnut Creek, CA, 0.5 and 0.75 lb [AI]/A), esfenvalerate (Asana XL 0.66, DuPont, 0.036 and 0.04 lb [AI]/A), bifenthrin (Capture 2EC, FMC, 0.05 and 0.06 lb [AI]/A and Discipline 2EC, Amvac, 0.05 lb [AI]/A), methomyl (Lannate 2.4LV, DuPont, 0.45 lb [AI]/A), indoxacarb (Steward 1.25, DuPont, 0.11 lb [AI]/A), emamectin benzoate (Denim 0.16EC, Syngenta, 0.0125 lb [AI]/A), cypermethrin (Ammo 2.5EC, FMC, 0.06 lb [AI]/A), methoxyfenozide (Intrepid 2F, Dow AgroSciences, 0.06 lb [AI]/A), acetamiprid (Intruder/Assail 70WP, DuPont, 0.025 and 0.05 lb [AI]/A), thiacloprid (Calypso 4, Bayer, 0.094 lb [AI]/A), malathion (Malathion 5, Terra International, Sioux City, IO, 0.773 lb [AI]/A), profenofos (Curacron 8, Syngenta, 0.75 lb [AI]/A), and flonicamid (F1785 50WG, FMC, 0.088 lb [AI]/A). To simulate practical efficacy in the field, 1 µl of each insecticide mixture 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. Mortality was recorded 24, 48, 72, and 96 hr after treatment.

Pheromone Trapping

Traps (22), modified from Mizell and Tedders (1995) and Greene et al. (2001a), were placed in and around cotton fields near Rowher, AR, during 2004. Major components of the traps were corrugated plastic, plastic jars, rubber septa, and synthetic pheromone. Trap tops were made from plastic jars, and trap bases were made from sheets (4' x 8' safety yellow) of 10-mm corrugated plastic board. Lures were placed in the plastic jar top of each trap and consisted of a rubber septum (sleeve stopper, Fisher Scientific) treated with 40 µl of methyl 2,4-decadienoate, and replaced every 7 d. Traps were examined and emptied once per wk.

Boll Infestation Cage Experiment

Adults and late instars of GSB were collected from soybeans with sweep net procedures and held until used in the experiments using procedures described previously. On 6 July, *lambda*-cyhalothrin (Karate 2.08CS at 0.04 lb [AI]/A), dicrotophos (Bidrin 8EC at 0.5 lb [AI]/A), spinosad (Tracer 4 at 0.09 lb [AI]/A), and mepiquat chloride (Pix Plus at 0.04375 lb [AI]/A) were applied to second-generation *Bt* cotton (ST4646B2R) planted on 19 April near the Southeast Research and Extension Center in Monticello, AR. On 7 July 2004, insect cages (each either 6 x 6 x 12 ft or 6 x 6 x 6 ft), constructed using 18 x 14 mesh screen and aluminum pipe frames, were placed over selected cotton rows. Beginning on 8 July, white blooms on enclosed cotton were tagged with fluorescent flagging tape and dated and repeated every 3 or 4 d. On 29 July, dicrotophos (Bidrin 8EC at 0.5 lb [AI]/A), spinosad (Tracer 4 at 0.09 lb [AI]/A), and *zeta*-cypermethrin (Mustang Max at 0.025 lb [AI]/A) were applied to caged plants, using a compressed-air backpack sprayer that delivered 10 gal/a at 50 psi, to kill arthropods present. 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 (Greene et al. 1999). 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. Cups were attached to tagged bolls during 6-10 August.

On 10 August, we addressed the effect of boll age on stink bug feeding and yield loss by confining adults and late 5th instars of *A. hilare* singly with bolls aged 6, 11, 15, 18, 22, 26, 29, and 33 d from white bloom using a completely randomized design. Paired bolls of corresponding age were caged without bugs as controls. After a 7-d exposure, bugs were removed from the cages. At maturity, cotton was manually harvested and weighed from each boll.

Boll-Injury Thresholds

Plots of ST4646B2R at the Rohwer Branch of the Southeast Research and Extension Center in Desha County, AR (16 rows by 70 ft) and FM960BR at a producer's farm in Desha County, AR (16 rows by 1300 ft) were arranged in a RCBD with 6 treatments and 4 replications. Twenty-five bolls (50-75% full size, ca. 14 d from white bloom) were collected from each plot weekly and examined for internal symptoms of feeding by stink bugs. A boll was considered damaged if at least one internal growth (cell proliferation) or obvious staining of lint with associated feeding injury to seeds was observed. 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. An additional treatment included an untreated control at both sites. Four rows from the center of each plot were harvested by machine.

Data were processed using Agriculture Research Manager (ARM) (Gylling Data Management, Inc., Brookings, SD), and means were separated using Least Significant Difference (LSD) procedures following significant F tests using Analysis of Variance (ANOVA).

Results and Discussion

Insecticide Efficacy

The predominant species of stink bugs in cotton in Southeast Arkansas during 2001-2004 were primarily the green stink bug (GSB), *Acrosternum hilare* (Say), and, to a lesser extent, the brown stink bug (BSB), *Euschistus servus* (Say). During most years in Arkansas, the southern green stink bug (SGSB), *Nezara viridula* (L.), was very common in soybeans but was not abundant in cotton until later in the season. The predominant species of stink bug in cotton in Southwest Georgia during 1999-2000 was SGSB, with GSB and BSB less common.

In topical bioassays evaluating contact efficacy, dicrotophos (Bidrin 8) and methyl parathion (Methyl 4E) provided excellent control (95-100%) of adults and nymphs of SGSB, BSB, and GSB (Tables 1-3, respectively) at the 0.5 lb AI/A rate 24 hr after exposure. Overall, the 0.5 lb AI/A rate of both products provided excellent control (97-98%) of all species combined at 24 hr (Table 4). The pyrethroid insecticides applied alone provided variable control (48-92%) of all species after 24 hr (Tables 4), but poorest control was demonstrated with BSB (18-91%, Table 2). When pyrethroids were applied in combination with an organophosphate, a carbamate, a neonicotinoid, or an insect growth regulator (IGR), control (78-97%) was also variable, depending on the grouping (Table 4). Centric plus Karate and CS-AU-44-JO provided good control of combined species, and Karate plus the IGR provided acceptable control of combined species when applied topically. As expected, Tracer, Intrepid, Steward, and Denim, lep-specific materials, offered little or no control (1-13%) of all species at 24 hr (Table 4). Cumulative mortalities for several treatments fluctuated slightly and, in some cases, decreased over time because some bugs recorded as dead apparently recovered from initial "knockdown". Results from 2004 were consistent with those found previously (Greene and Herzog 2000, Greene et al. 2001a, Greene and Capps 2002, Greene and Capps 2003) and are presented collectively with those from 1999-2003.

Pheromone Trapping

Over an 8-wk sampling period, approximately 95% of stink bugs trapped in 22 traps around cotton were part of the brown stink bug complex, *Euschistus* spp. The majority were *E. servus*, with some *E. tristigmus*, *E. crenator*, and *E. ictericus*. Others included *Thyanta* sp., *A. hilare, N. viridula*, and *Oebalus pugnax*. Weekly capture in pheromone traps declined during late July and increased during August (Figure 1). Highest trap numbers and field populations, detected with shake sheet procedures, were obtained during late June and early July but likely would have peaked in late August and early September, as observed in previous years, if sampling had continued. The increases in numbers in August and September observed in previous years occurred after a trend for increasing trap capture began in early August, as was observed in 2004 (Greene et al. 2001a, Greene and Capps 2003).

Boll Infestation Cage Experiment

As bolls aged, damage and yield loss decreased (Figure 2). Significant yield loss did not occur with bolls aged 22, 29 or 33 d from anthesis that had accumulated over 558 heat units (HU). In our earlier findings using a related species, the southern green stink bug, *Nezara viridula* (L.), results were almost identical where bolls aged 25 and 30 d that had accumulated 559 and 658 HU, respectively, did not incur yield loss (Greene et al. 2001a). In earlier tests with *N. viridula* (Greene and Herzog 2000), 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 field-collected/laboratory-held stink bugs confined to single bolls for an entire week. Considering the effects of shading and extended length of exposure to bug injury, bolls are likely safe from significant yield loss due to stink bugs when they attain an age of 21-25 d from anthesis (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 photosynthetic energy and because of the artificially intimate and intense exposure to stink bugs in the enclosures, this should be a conservative estimate. Because bolls 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.

Boll-Injury Thresholds

During 2004, two fields in southeast Arkansas were established for research addressing boll-injury thresholds for stink bugs. Data from both sites were pooled for analyses. On average, 2.5 and 1.0 application of dicrophos (Bidrin 8) at 0.5 lb (AI)/A at thresholds of 10 and 20% internal boll injury resulted in ca. 55 and 16 lb, respectively, increases in lint yield when compared with untreated plots. In-field populations were not detected at the threshold of 1 bug per 6 row feet using a shake sheet. These data are similar to those summarized from earlier tests (Greene and Capps 2003). In these trials, significant populations of tarnished plant bug (TPB), *Lygus lineolaris*, were present for most of the fruiting period and, although treated 2-4 times with insecticide specifically for control of TPB, caused significant injury to small bolls. The benefits of treating earlier for stink bugs at the 10% level of injury undoubtedly resulted in reduced numbers of both TPB and stink bugs and increased returns.

Considering past research experiences, when populations of boll-feeding bugs are predominantly comprised of stink bugs, cotton with bolls protected at the 20% level of internal injury produces the highest yields and net return (Greene and Capps 2003). Under conditions of high TPB pressure, coupled with numbers of stink bugs, protection in the 10-20% range of boll injury apparently provides supplemental protection from TPB and results in highest yields and net returns. Recommendations in most states include some variation of a boll-injury threshold for stink bugs and other boll-feeding bugs. As a result of these continuing studies, alternative monitoring and management recommendations are available for stink bugs in cotton.

Acknowledgments

We thank Cotton Incorporated, Arkansas cotton producers, AMVAC, Bayer, Cheminova, Control Solutions, Dow AgroSciences, DuPont, FMC, Syngenta, and Crompton/Uniroyal for support of this work.

Disclaimer

The mention of trade names in this report is for informational purposes only and does not imply an endorsement by the University of Arkansas Cooperative Extension Service.

References

Greene, J. K., S. G. Turnipseed, M. J. Sullivan, and G. A. Herzog. 1999. Boll damage by southern green stink bug (Hemiptera: Pentatomidae) and tarnished plant bug (Hemiptera: Miridae) caged on transgenic *Bacillus thuringiensis* cotton. J. Econ. Entomol. 92(4): 941-944.

Greene, J. K. and G. A. Herzog. 2000. Mortality of southern green stink bug exposed to new cotton insecticides in laboratory bioassays and field comparisons of insecticides and stink bug damage to cotton. 1999 Georgia Cotton Research and Extension Reports. UGA/CPES Research-Extension Publication No.4: 251-255.

Greene, J. K., G. A. Herzog, and P. M. Roberts. 2001a. Management decisions for stink bugs. 2001 Proceedings of the Beltwide Cotton Conference 2: 913-917.

Greene, J. K., S. G. Turnipseed, M. J. Sullivan, and O. L. May. 2001b. Treatment thresholds for stink bugs (Hemiptera: Pentatomidae) in cotton. J. Econ. Entomol. 94(2): 403-409.

Greene, J. K. and C. D. Capps. 2002. Efficacy of insecticides for control of stink bugs. 2002 Proceedings of the Beltwide Cotton Conference.

Greene, J. K. and C. D. Capps. 2003. Management considerations for stink bugs. 2003 Proceeding of the Beltwide Cotton Conference, pp. 1464-1469.

Harris, V. E and J. W. Todd. 1981. Rearing the southern green stink bug, *Nezara viridula*, with relevant aspects of its biology. J. Ga. Entomol. Soc. 16: 203-210.

Mizell, R. F. and W. L. Tedders. 1995. A new monitoring method for detection of the stink bug complex in pecan orchards. In Proceedings, 1995 Pecan Grow. Assoc. 88: 36-40.

Willrich, M. M., K. Emfinger, B. R. Leonard, D. R. Cook, and J. Gore. 2002. Modified AVT: susceptibility of stink bugs to selected insecticides. 2002 Proceedings of the Beltwide Cotton Conference.

Willrich, M. M., D. R. Cook, J. H. Temple, B. R. Leonard, and J. Gore. 2003. When does brown stink bug, *Euschistus servus* (Say), begin to injure cotton? 2003 Proceedings of the Beltwide Cotton Conferences, pp. 1195-1201.

Table 1. Cumulative mortality of field-collected nymphs and adults of the southern green stink bug, *Nezara viridula* (L.), over a 4-d interval following exposure to insecticides (1-µl to ventral abdominal segments) in laboratory bioassays (1999-2004).

Treatment (lb [AI]/Acre)	**Reps**	**% Corrected Mortality**			
		24 hr	**48 hr**	**72 hr**	**96 hr**
UTC	515	4	10	15	21
Prolex 1.25 @ 0.015	98	86	86	88	87
Vydate 3.77 @ 0.25	98	68	77	77	76
Vydate 3.77 @ 0.31 or 0.33	98	68	69	72	70
Methyl parathion 4 @ 0.25	98	95	97	98	97

Methyl parathion 4 @ 0.5	98	97	99	100	100
Orthene 97 @ 0.5	302	67	77	81	82
Orthene 97 @ 0.75	98	90	97	96	96
Tracer 4 @ 0.067 or 0.07	515	12	11	13	15
Karate 2.08 @ 0.03	98	94	93	93	92
Asana 0.66 @ 0.04	98	50	59	64	63
Bidrin 8 @ 0.25	303	97	96	96	96
Bidrin 8 @ 0.5	515	98	98	98	98
Diamond 0.83 @ 0.058	98	39	59	65	67
Mustang Max 0.8 @ 0.018	212	97	96	98	99
Mustang Max 0.8 @ 0.02 or 0.022	98	93	93	94	94
Discipline 2 @ 0.05	98	90	90	90	90
Centric 25 or 40 WG @ 0.05	98	87	86	88	87
Leverage 2.7 @ 0.0634	362	94	89	85	86
Leverage 2.7 @ 0.07	98	97	90	87	86
Lannate 2.4 @ 0.45	98	75	80	81	79
Steward 1.25 @ 0.11	417	8	12	14	16
Denim 0.16 @ 0.0125	405	20	27	37	42
Baythroid 2 @ 0.03 or 0.033	417	84	87	85	87
Ammo 2.5 @ 0.06	302	90	93	92	92
Fury 1.5 @ 0.0375	302	94	95	94	95
Capture 2 @ 0.05	302	80	77	77	76
Provado 1.6 @ 0.047	302	58	55	53	52
Asana 0.66 @ 0.036 + Vydate 3.77 @ 0.25	98	73	73	76	74

Table 2. Cumulative mortality of field-collected nymphs and adults of the brown stink bug, *Euschistus servus* (Say), over a 4-d interval following exposure to insecticides (1-µl to ventral abdominal segments) in laboratory bioassays (1999-2004).

Treatment (lb [AI]/Acre)	**Reps**	**% Corrected Mortality**			
		24 hr	**48 hr**	**72 hr**	**96 hr**
UTC	240	8	14	18	21
Prolex 1.25 @ 0.015	22	21	21	28	25
Vydate 3.77 @ 0.25	22	80	79	78	77
Vydate 3.77 @ 0.31 or 0.33	22	100	100	100	100
Methyl parathion 4 @ 0.25	22	85	89	89	89
Methyl parathion 4 @ 0.5	22	95	100	100	100

Orthene 97 @ 0.5	154	66	80	87	86
Orthene 97 @ 0.75	113	73	92	95	96
Tracer 4 @ 0.067 or 0.07	240	0	5	13	16
Karate 2.08 @ 0.03	135	40	43	54	60
Bidrin 8 @ 0.25	60	98	98	98	98
Bidrin 8 @ 0.33	113	97	98	98	98
Bidrin 8 @ 0.5	240	98	98	98	98
Diamond 0.83 @ 0.08	22	-3	-11	-16	2
Lorsban 4 @ 0.5	22	2	26	45	66
Mustang Max 0.8 @ 0.018	41	45	32	41	38
Mustang Max 0.8 @ 0.02 or 0.022	22	80	74	72	71
Centric 25 or 40 WG @ 0.05	135	73	72	73	72
Leverage 2.7 @ 0.0634	218	65	57	54	51
Leverage 2.7 @ 0.079	22	75	79	78	71
Steward 1.25 @ 0.11	218	-1	0	3	4
Denim 0.16 @ 0.0125	194	12	17	28	27
Baythroid 2 @ 0.03 or 0.033	109	27	27	25	21
Baythroid 2 @ 0.04	113	43	36	37	37
Ammo 2.5 @ 0.06	105	18	13	11	12
Fury 1.5 @ 0.0375	105	31	28	26	28
Fury 1.5 @ 0.0445	113	58	68	56	56
Capture 2 @ 0.05	105	62	59	52	51
Capture 2 @ 0.06	113	91	95	96	97
Provado 1.6 @ 0.047	105	31	25	15	11
Trimax 4 @ 0.047	22	21	10	6	8
Intrepid 2 @ 0.06	113	1	3	7	16
Intruder (Assail) 70WP @ 0.025	113	13	11	10	7
Intruder (Assail) 70WP @ 0.05	113	23	22	22	18
Calypso @ 0.094	113	4	2	1	-2
Malathion 5 @ 0.773	207	33	44	53	55
Curacron 8 @ 0.75	110	14	22	31	35
Trimax 4 @ 0.03125 + Bidrin 8 @ 0.25	22	95	95	94	94
Diamond 0.83 @ 0.039 + Karate 2.08 @ 0.025	22	46	58	67	77
Centric 40WG @ 0.03125 + Karate 2.08 @ 0.02	22	95	95	94	89

CS-AU-44-JO @ 1 qt/acre	22	90	89	94	94

Table 3. Cumulative mortality of field-collected nymphs and adults of the green stink bug, *Acrosternum hilare* (Say), over a 4-d interval following exposure to insecticides (1-µl to ventral abdominal segments) in laboratory bioassays (1999-2004).

Treatment (lb [AI]/Acre)	**Reps**	**% Corrected Mortality**			
		24 hr	**48 hr**	**72 hr**	**96 hr**
UTC	519	14	26	38	46
Prolex 1.25 @ 0.015	336	77	76	80	82
Vydate 3.77 @ 0.25	336	74	78	83	62
Vydate 3.77 @ 0.31 or 0.33	120	91	94	95	97
Methyl parathion 4 @ 0.25	120	87	98	97	97
Methyl parathion 4 @ 0.5	358	97	99	100	100
Methyl parathion 4 @ 1.0	169	100	100	100	100
Orthene 97 @ 0.5	345	52	66	72	79
Orthene 97 @ 0.75	345	64	80	86	89
Tracer 4 @ 0.067 or 0.07	497	6	9	11	15
Karate 2.08 @ 0.03	328	84	83	87	89
Asana 0.66 @ 0.04	231	45	49	56	60
Bidrin 8 @ 0.25	167	93	93	94	93
Bidrin 8 @ 0.33	330	96	96	97	97
Bidrin 8 @ 0.5	497	98	98	99	99
Diamond 0.83 @ 0.058	62	6	23	19	11
Diamond 0.83 @ 0.08	105	8	22	16	30
Lorsban 4 @ 0.5	105	62	86	85	82
Mustang Max 0.8 @ 0.018	169	93	92	98	91
Mustang Max 0.8 @ 0.02 or 0.022	167	94	90	90	90
Discipline 2 @ 0.05	62	79	78	79	76
Centric 25 or 40 WG @ 0.05	328	86	90	92	89
Leverage 2.7 @ 0.0634	161	95	95	96	98
Leverage 2.7 @ 0.07	62	77	80	82	79
Leverage 2.7 @ 0.079	105	100	100	100	95
Lannate 2.4 @ 0.45	84	78	79	87	85
Steward 1.25 @ 0.11	161	-3	3	17	31
Denim 0.16 @ 0.0125	161	1	5	21	27
Baythroid 2 @ 0.03 or 0.033	105	83	86	88	86

2005 Beltwide Cotton Conferences, New Orleans, Louisiana - January 4 - 7, 2005

Baythroid 2 @ 0.04	161	85	85	94	97
Baythroid XL @ 0.015	169	85	76	73	81
Baythroid XL @ 0.018	169	86	86	88	97
Fury 1.5 @ 0.0445	161	88	92	95	95
Capture 2 @ 0.05	169	90	89	90	91
Capture 2 @ 0.06	161	75	80	90	92
Trimax 4 @ 0.0469	274	76	77	77	79
Intrepid 2 @ 0.06	161	-4	-7	-3	-10
Intruder (Assail) 70WP @ 0.025	161	36	30	38	41
Intruder (Assail) 70WP @ 0.05	161	54	55	65	68
Calypso @ 0.094	161	8	14	15	2
Malathion 5 @ 0.773	245	18	21	26	20
Curacron 8 @ 0.75	135	10	25	36	40
Karate 2.08 @ 0.025 + Bidrin 8 @ 0.25	169	90	90	90	91
Trimax 4 @ 0.03125 + Bidrin 8 @ 0.25	105	99	99	100	100
Diamond 0.83 @ 0.039 + Karate 2.08 @ 0.025	105	91	91	94	93
Centric 40WG @ 0.03125 + Karate 2.08 @ 0.02	105	98	100	100	100
Asana 0.66 @ 0.036 + Vydate 3.77 @ 0.25	231	79	79	81	82
F1785 @ 0.088	169	21	24	26	42
CS-AU-44-JO @ 1 qt/acre	274	98	99	99	99
Phaser 3 @ 1.0	22	95	94	100	100

Table 4. Cumulative mortality of field-collected nymphs and adults of the green stink bug, *Acrosternum hilare* (Say), the southern green stink bug, *Nezara viridula* (L.), and the brown stink bug, *Euschistus servus* (Say), over a 4-d interval following exposure to insecticides (1-µl to ventral abdominal segments) in laboratory bioassays (1999-2004).

Treatment (lb [AI]/Acre)	**Reps**	**% Corrected Mortality**			
		24 hr	**48 hr**	**72 hr**	**96 hr**
UTC	1274	9	18	25	31
Prolex 1.25 @ 0.015	456	77	77	81	82
Vydate 3.77 @ 0.25	456	74	79	83	71
Vydate 3.77 @ 0.31 or 0.33	240	82	84	85	85
Methyl parathion 4 @ 0.25	240	90	96	97	96
Methyl parathion 4 @ 0.5	478	97	99	100	100

Methyl parathion 4 @ 1.0	169	100	100	100	100
Orthene 97 @ 0.5	801	61	73	79	82
Orthene 97 @ 0.75	556	72	86	91	93
Tracer 4 @ 0.067 or 0.07	1252	7	9	12	15
Karate 2.08 @ 0.03	561	75	75	80	82
Asana 0.66 @ 0.04	329	48	55	62	65
Bidrin 8 @ 0.25	530	96	95	96	95
Bidrin 8 @ 0.33	443	97	97	97	98
Bidrin 8 @ 0.5	1252	98	98	98	98
Diamond 0.83 @ 0.058	160	27	46	50	49
Diamond 0.83 @ 0.08	127	10	23	20	35
Lorsban 4 @ 0.5	127	53	76	79	82
Mustang Max 0.8 @ 0.018	422	90	88	89	90
Mustang Max 0.8 @ 0.02 or 0.022	287	92	90	91	90
Discipline 2 @ 0.05	160	86	86	87	86
Centric 25 or 40 WG @ 0.05	561	83	85	86	85
Leverage 2.7 @ 0.0634	741	85	80	76	75
Leverage 2.7 @ 0.07	160	90	86	85	84
Leverage 2.7 @ 0.079	127	96	96	96	91
Lannate 2.4 @ 0.45	182	76	79	83	82
Steward 1.25 @ 0.11	796	2	4	6	8
Denim 0.16 @ 0.0125	760	13	18	28	31
Baythroid 2 @ 0.03 or 0.033	631	74	75	73	72
Baythroid 2 @ 0.04	274	68	65	68	69
Baythroid XL @ 0.015	169	86	78	78	85
Baythroid XL @ 0.018	169	87	88	90	97
Ammo 2.5 @ 0.06	407	70	71	68	67
Fury 1.5 @ 0.0375	407	77	76	74	74
Fury 1.5 @ 0.0445	274	76	77	78	77
Capture 2 @ 0.05	576	79	76	74	73
Capture 2 @ 0.06	274	83	87	93	95
Provado 1.6 @ 0.047	407	49	43	36	33
Trimax 4 @ 0.0469	296	73	74	75	77
Intrepid 2 @ 0.06	274	1	2	8	10
Intruder (Assail) 70WP @ 0.025	274	28	25	29	29

Intruder (Assail) 70WP @ 0.05	274	42	43	48	47
Calypso @ 0.094	274	9	13	14	7
Malathion 5 @ 0.773	452	27	35	43	43
Curacron 8 @ 0.75	245	14	26	36	40
Karate 2.08 @ 0.025 + Bidrin 8 @ 0.25	169	90	91	92	93
Trimax 4 @ 0.03125 + Bidrin 8 @ 0.25	127	98	98	99	99
Diamond 0.83 @ 0.039 + Karate 2.08 @ 0.025	127	84	86	90	91
Centric 40WG @ 0.03125 + Karate 2.08 @ 0.02	127	97	99	99	98
Asana 0.66 @ 0.036 + Vydate 3.77 @ 0.25	329	78	78	81	82
F1785 @ 0.088	169	26	33	39	55
CS-AU-44-JO @ 1 qt/acre	296	98	98	99	99

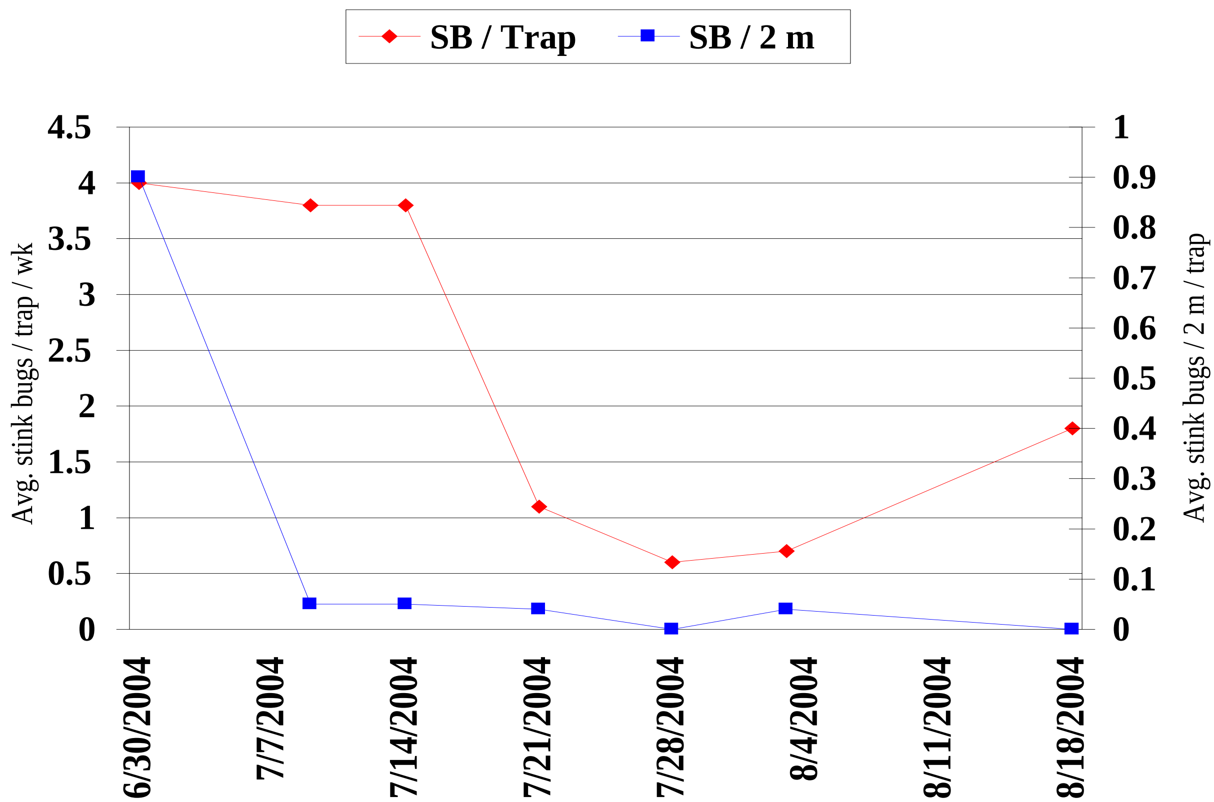

Figure 1. Weekly average number of stink bugs in pheromone-baited traps and shake sheet samples from cotton near Rohwer, AR (2004).

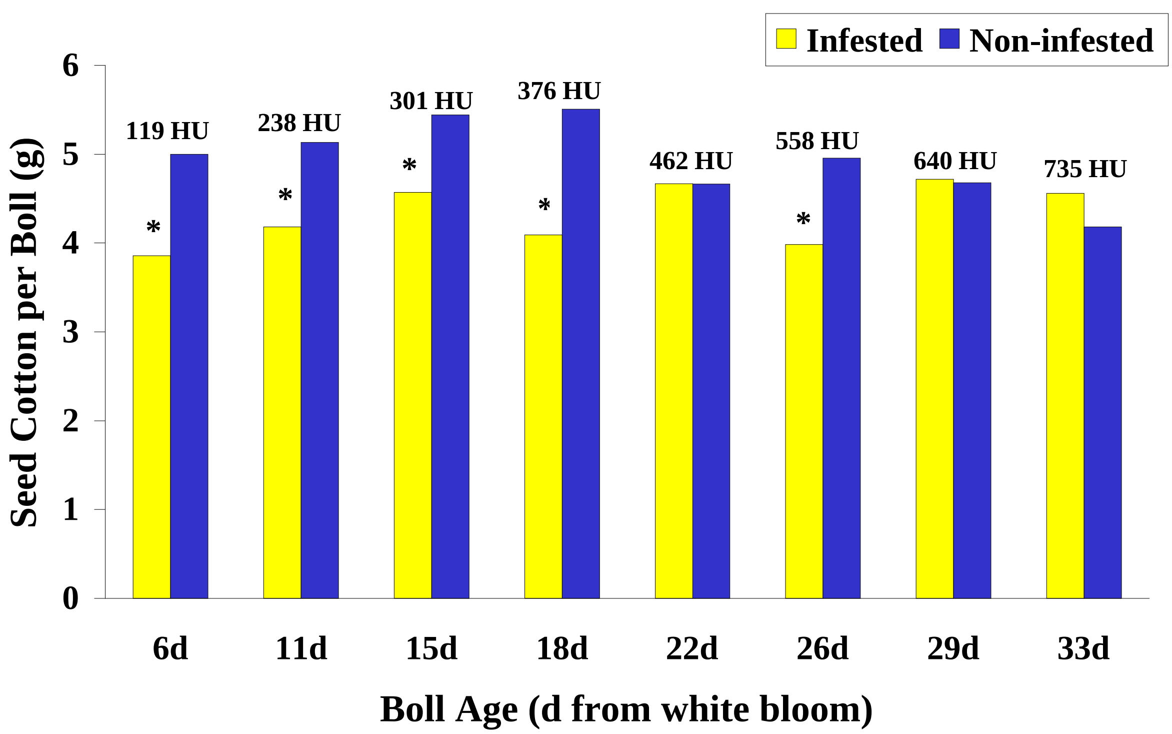

Figure 2. Yields following 1-wk exposure of bolls of varying ages to adults and late 5th instars of green stink bug, *Acrosternum hilare* (Say), from ST4646B2R cotton in 2004. *Significant difference P < 0.05. HU, heat units (calculated by averaging daily temperature F°- 60 for each day).