RESULTS FROM TWO YEARS OF AN EXPERIMENT ON TARNISHED PLANT BUG CONTROL IN COTTON THROUGH REDUCTION IN NUMBERS OF EARLY-SEASON WILD HOST PLANTS

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Abstract

An experiment that evaluated control of tarnished plant bug (TPB), *Lygus lineolaris* (Palisot de Beauvois), populations in cotton, *Gossypium hirsutum* L., by reduction with herbicides in numbers of broad leaf wild host plants found near fields was conducted in Sunflower and Washington Counties in the Delta of Mississippi in 1998 and 1999. Four experimental areas each approximately square and 4.8 km on a side were used in both years. Check areas received no herbicide treatment, while treated areas (one area in 1998 and two areas in 1999) received an application of Trimec® (mecoprop + 2, 4-D + dicamba) at 1.55 + 0.54 + 0.17 kg AI/ha applied with a spray system mounted on a tractor in April of both years. This herbicide kills broad leaf weeds but not grasses. In 1998, only the larger areas with good stands of wild hosts were treated with Trimec, while smaller areas with good stands of hosts were spot-treated with glyphosate (0.22 kg AI/ha) using an all terrain vehicle and hand-held wand spray system. Approximately 25% of the marginal areas with wild hosts were treated with herbicides in the treated test area in 1998. Over 90% of the marginal areas with wild hosts were treated with the tractor and Trimec in the two treated areas used in 1999. The herbicide treatment significantly reduced numbers of broad leaf hosts in sample areas in the treated areas as compared to check areas in both years. A corresponding reduction in numbers of TPB found in the sample areas in the treated areas as compared to the check areas was also found. However, in 1999 numbers of TPB found on wild hosts in the treated test areas in posttreatment samples had increased significantly as compared to their numbers found in pretreatment samples. This increase was caused by TPB utilizing annual rye grass, *Lolium multiflorum* Lamarck, as a host in the treated areas. In 2000, Trimec will be applied in the treated test areas in late-February and early-March to destroy the F TPB population and avoid this problem. Average numbers of TPB in cotton fields in 1999 were 3-fold lower in the two treated test areas as compared to their numbers in cotton fields in the two check test areas. The numbers in cotton in the treated areas were significantly lower in the last two weeks of July. Numbers of TPB found in cotton in the four test areas in 1998 were too low for statistical analyses.

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Introduction

In the delta region of the mid-south in Arkansas, Louisiana, and Mississippi 169 host plant species for the tarnished plant bug (TPB), *Lygus lineolaris* (Palisot de Beauvois), have been found, most of which are weed species (Snodgrass et al. 1984). The presence of weed hosts in the spring allows TPB populations to increase before moving into cotton, *Gossypium hirsutum* L., which is the main crop in the mid-south damaged by TPB (Tugwell et al. 1976, Cleveland 1982, Snodgrass et al. 1984). TPB are controlled in cotton almost exclusively with insecticides, and are considered a key early-season pest of cotton in the mid-south (Scott et al. 1985). Eradication of the boll weevil, *Anthonomous grandis* Boheman, is currently being conducted in the mid-south, and when this has been completed, TPB could be the main early season pest of cotton in this area in most years. Treatment of cotton in early season with insecticides for TPB control could reduce many of the benefits in cotton production obtained through boll weevil eradication. Control of TPB in cotton using methods not solely based on insecticides would greatly improve insect management in cotton. Area-wide management of weed hosts aimed at reducing numbers of TPB that could move into cotton has never been tested, but could be one alternative method of TPB control.

Fleischer and Gaylor (1987) thought that management of selected growth stages of selected wild host species over a short time frame might result in effective area-wide programs for TPB in heavily cropped agroecosystems such as the Highland Rim area of Alabama. They singled out daisy fleabanes [*Erigeron annuus* (L.) Persoon and *E. strigosus* Muhlenberg ex Willdenow], as having the densest populations of TPB during the time cotton was in an early square growth stage, and thought that management of the two fleabanes could affect TPB populations in the Highland Rim area. The delta region of the mid-south is another heavily cropped area in which wild plant hosts of the TPB are restricted to growth in marginal areas around fields, ditches and roads. Eliminating broad leaf TPB host plants with herbicides or by mowing in these marginal areas could be economically feasible because of the small land area involved. Destruction of broad leaf weeds would also reduce the amount of *Geranium dissectum* L. and *G. carolinianum* L., which are the main wild hosts on which the F1 bollworm, *Helicoverpa zea* Boddie, and tobacco budworm, *Heliothis virescens* (F.) generations are produced in the mid-south (Stadelbacher 1981).

An experiment designed to evaluate whether or not TPB could be controlled in cotton by reduction in numbers of wild host plants in marginal areas around fields in April was conducted in the Delta of Mississippi in 1998 and 1999. Results from both years of the study are presented in this manuscript.

Materials and Methods

An experiment was conducted in 1998 and 1999 in Sunflower and Washington Counties in the Delta of Mississippi. Four approximately square test areas 4.8 km on a side were used in the experiment in both years. One of the four test areas (treated area) in 1998 received herbicide and mowing treatments in marginal areas by fields, ditches and roads which had stands of wild host plants. The other three test areas were checks and received no mowing or herbicide treatments. In 1999 two of the four test areas received the treatments, while the other two test areas were checks. In both years three of the test areas were in Washington County while the 4th test area was in Sunflower County. The treated test area in 1998 was located near Tribbett and it also served as a treated test area in 1999. In 1998 one check test area was 1.0 km due south of the treated test area at Tribbett, while the 2nd check area was just east of Hollandale. The last check area was located near Kenlock (Sunflower County). In 1999 the 2nd treated test area was located near Dunleith; the check test area 1.0 km south of Tribbett was dropped from the test; and the two check test areas near Hollandale and Kenlock were used again.

Herbicides were applied with a John Deere 2355 tractor® (John Deere Co., Moline, IL) fitted with a 18.3 m spray-boom having 36 cone 2X nozzles, and calibrated to deliver 43.2 liter/ha at 13.6 kg/cm^2. A John Deere bushhog (Model 609, 1.8 m cut) was also used with the tractor for mowing treatment. Herbicides used were glyphosate (Roundup Ultra RT®, Monsanto Co., St. Louis, MO) and a combination of mecoprop, 2,4-D, and dicamba (Trimec®, PBI/Gordon Corp., Kansas City, KS). Use rate for Trimec was 1.55 + 0.54 + 0.17 kg AI/ha for mecoprop, 2, 4-D, and dicamba, respectively, and it was applied to most treated areas to kill broad leaf weeds but not grasses. Glyphosate was applied as a spot treatment to small areas with dense stands of hosts using an all terrain vehicle (Honda Foreman®, Honda, Inc., Marysville, OH) fitted with a hand-held wand spray system (Bell Manuf., Inverness, MS) calibrated to deliver 2.2 kg AI/ha. Treatments were applied during the 3rd and 4th weeks of April in 1998 and in the last week of March and 1st two weeks of April in 1999. Mowing was mostly used as a treatment in areas where herbicide use was impracticle (near houses or ponds).

Each of the four test areas was divided into approximately equal quadrants for sampling purposes. Marginal areas with good stands of wild hosts extending at least 100 m in length were identified and located on aerial maps of the four test areas. These maps were obtained from the Geographic Information Satellite Center at the Delta Research and Extension Center, Stoneville, MS. The identified marginal areas with wild hosts were used for sampling TPB and to determine host plant species and densities. All of these marginal areas in the treated area were treated with Trimec, except for one area which was closely mowed (within 1.25 cm of the ground) in 1998. Quadrants in all of the four test areas contained from one to five of these sample areas. Samples were taken at four locations within each sample area in 1998, while three locations in each sample area were used in 1999. The distance from the beginning of each sample area to the first sample location, and distances between each sample location, ranged from 5 to 25 m and were selected at random. At each sample location, a rope 7.62 m in length marked in 0.31-m-intervals was placed lengthwise through the middle of the area of wild hosts being sampled. Vegetation on each side of the rope was sampled with a sweep net and the numbers of TPB adults and nymphs captured were determined and recorded, as were the number of sweeps taken. No effort was made to separate the number of TPB captured by host plant species since the hosts were usually mixed together. The width of each sample area was measured with a Wheel-Roadrunner® (Model RR418, Keson Co., Neperville, IL) at each end and near the middle of the rope. Sweep net sampling was performed prior to taking width and plant density measurements to avoid disturbing TPB on the hosts in the sample area before the hosts were sampled. Host plant density was determined by counting the broad leaf plants known to be hosts found within a wire ring which encompassed an area of 0.25 m^2. Counts were recorded by plant species and were taken at four places along the 7.62 m rope by random selection of four of the 25 distances marked at 0.31-m-intervals along the rope. The ring was laid beside the rope at each distance selected and the counts were taken. Placement of the ring on the left or right side of the rope was also selected at random for each of the four counts. Sampling that determined host plant density and TPB populations on wild hosts was performed in all four test areas in 1998 during the 1st two weeks of April and again after the treatments were applied in the treated area during the 2nd and 3rd weeks of May. The pretreatment counts were taken in the areas in 1999 during the last week in March and the first week in April. The posttreatment counts were taken the last week in April and 1st week in May.

A rough estimate of the total area of wild hosts present in the treated test areas in 1998 and 1999 was obtained by measuring the width of the marginal areas with hosts. Part of these width measurements came from the areas with good stands of wild hosts in which wild host plant density and TPB populations on them were determined, as described previously. Widths of the other areas with hosts were also

obtained using the Wheel-Roadrunner. These included areas that were treated, and untreated areas in which few broad leaf hosts were present. These measurements were taken as far apart as approximately 50 m in areas where the width did not vary much (straight stretches along roads or ther areas). In marginal areas where the width changed frequently, they were taken 10-30 m apart. Length measurements were obtained from the aerial maps or by use of the odometer from a truck or all terrain vehicle. In all four of the test areas in 1998 and 1999 most growers practiced "burndown" of their fields in which weeds in the fields were killed by treatment with paraquat or glyphosate in late-February and March. Part of the marginal areas with wild hosts near fields, especially the margins of field roads were also frequently treated. The marginal areas treated by the growers were not measured. The "burndown" killed all broad leaf hosts and grasses in these areas.

Cotton fields in all four test areas were sampled for TPB each week in 1998 beginning in the 2nd week in June and ending in the 1st week of August. Cotton fields were sampled for TPB in 1999 in each week in June and July. All cotton fields in each quadrant of each test area were located and identified on the aerial maps. Approximate field size was determined by determining row spacing, counting the number of rows in each field, and by measuring field length with the odometer of a truck. Sample fields were chosen each week at random from each quadrant. A total of 14 out of 30 fields were sampled in the treated area in 1998, while 33 out of 75 fields from the three check areas were sampled in most weeks. Fifteen cotton fields from each of the four test areas were chosen at random and sampled each week in 1999. Sampling was done with a sweep net, and each sample was 10 sweeps with a standard (38-cm diam.) sweep net moved back and forth across a single row of cotton. Number of samples was determined by field size and varied from 10 to >50 in both years. Numbers of TPB adults and nymphs captured were recorded in the field.

Data from counts of wild host densities and TPB counts from wild hosts and cotton were analyzed using analysis of variance with the PROC MIXED procedure of SAS (Littell et al. 1996). Data were transformed prior to analysis using log or square root transformations to determine if either transformation made the data more normally distributed. Actual means are shown in all tables. Data from pretreatment counts in 1998 were analyzed using within area variance (quadrant to quadrant) as the error term. Since there was no significant differences in wild host plant densities in the sample areas in the four test areas in the pretreatment counts, after treatment plant densities were compared using the mean for the single treated area and the mean for all three check areas. The error term was between area variance. Neither transformation improved the distribution of the TPB counts from wild hosts or cotton in 1998, since these data frequently had counts of zero. Therefore, a non-parametric approach was used to compare TPB counts from the wild hosts in the treated and check areas. These comparisons were made by constructing contingency tables using the maximum likelihood chi-square procedure (PROC FREQ, SAS Institute 1989). Mean numbers of TPB per sweep were put into four categories zero (0.00), low (0.01-0.30), medium (0.31-1.00), and high (>1.00). The percentages of the total number of observations found in each of the four categories were compared between the treated and three check areas. Because of the non-replication of the treated area and high number of samples with counts of zero, no analyses could be performed on the sampling data from cotton in 1998. There was no statistical problem with TPB counts from wild hosts or cotton in 1999. In this year pretreatment and posttreatment TPB counts from wild hosts, and TPB counts from cotton were obtained from two treated and two check areas.

Results

A total of 28.7 ha was estimated to have wild host plants in the treated test area at Tribbett in 1998. Of the 28.7 ha of marginal hosts, 7.9 ha (27.5%) were estimated to have been treated with Trimec or glyphosate as part of the experiment during the 3rd and 4th weeks of April. Only about 0.5 ha of the 7.9 ha that was treated was spot-treated with glyphosate. The one marginal sample area that was mowed on April 15 had regrowth of many of the wild hosts when it was sampled on 12 May. It was treated with Trimec after it was sampled. Most of the marginal areas with wild hosts were treated with Trimec in 1999, as opposed to 1998 in which the treatments were applied mostly to areas which had good stands of wild hosts. The treated test areas at Tribbett and Dunleith in 1999 were estimated to have 25.8 and 25.9 ha with wild hosts, respectively, of which 24.6 ha at Tribbett (95%) and 24.1 ha at Dunleith (93%) were treated with Trimec. No glyphosate was used as a spot-treatment in 1999. One area (about 0.4 ha) near a house was mowed once in April and again in May.

Pretreatment means for all wild hosts in 1998 were 18.1, 28.2, 19.8, and 29.9 hosts per m^2 for the treated test area and the three check test areas, respectively. These were not significantly different ($F = 2.41$; df = 1, 12; $P = 0.15$). The treated area had a wild host plant density of 7.8 per m^2 posttreatment, which was significantly lower ($F = 12.76$; df = 1, 2; $P = 0.07$) than the host density of 26.0 per m^2 found in the three check areas. Pretreatment host plant densities in the two check test areas were not significantly different from their densities in the two treated test areas in 1999 (Table 1). Posttreatment the treated areas had significantly lower numbers of wild hosts than the two check areas. Numbers of hosts also declined significantly in the two check areas from pretreatment to posttreatment. This decline was caused by the maturation and death of some of the host species and the activities of growers (plowing of some marginal areas). The

use of Trimec on the sample areas with good host densities significantly reduced the numbers of hosts in both years, but did not totally eliminate them. The surviving hosts were probably those not contacted with a lethal dose of Trimec because of thick vegetation. The most abundant broad leaf wild host plants found in the study in both years are shown in Table 2.

Numbers of TPB found by sweep net sampling of wild hosts in the treated test area in the pretreatment counts were higher in number per sweep in 1998 than in all three of the check areas [0.234 per sweep as compared to 0.229, 0.130 and 0.15 per sweep in the three check areas (check $\bar{x}$ = 0.170)]. Posttreatment average numbers of TPB per sweep in the three check test areas were 0.73, 0.28, and 0.34 ($\bar{x}$ = .451), as compared to 0.11 per sweep in the treated test area. The posttreatment average count for TPB in all three check test areas (0.451 per sweep) was 2.65-fold higher than the pretreatment average (0.170 per sweep) for these areas. The posttreatment count from the treated test area (0.11 per sweep) was 2.1-times lower than the pretreatment count (0.234 per sweep) in the treated area. The posttreatment numbers of TPB found per sweep on the wild hosts in the four test areas in 1998 were placed into four response categories and analyzed for differences in the distribution of the percentages of the counts in each category (Table 3). The distributions were significantly different (chi-square - 111.3, df = 9, P = 0.001). In the treated test area most samples (90%) had mean numbers of TPB per sweep in the lowest (0.00, or 0.01-0.30) categories. In the three check test areas less than 5% of the samples were in the 0.00 category. Most samples in the check test areas at Hollandale and Kenlock were in the 0.01-0.30 or 0.31-1.0 categories, while the check test area south of Tribbett had lower numbers of samples in these two categories and about 27% of all samples in the 1.00 or greater category. Post-treatment numbers of TPB on the wild host plants in the two check test areas and in the two treated test areas increased significantly in mean numbers per sample as compared to their pretreatment numbers in 1999 (Table 4). Pretreatment numbers of TPB per sample in the two check test areas were not significantly different from the numbers found in the two treated test areas. In the posttreatment samples the two treated areas had significantly lower numbers of TPB per sample than were found in the two check test areas. The significant increase in TPB numbers in the treated test areas from pretreatment to posttreatment was unexpected. Most of the broad leaf plants in these areas were dead when they were sampled. However, Trimec herbicide does not kill grasses and the samples areas in both treated test areas had abundant amounts of annual rye grass, *Lolium multiflorum* Lamarck, which blooms in late-April and May. This grass was sampled in the pretreatment and posttreatment samples since it grew intermixed with broad leaf hosts in many of the sample areas. TPB were not observed on the rye grass in the process of taking the pretreatment samples, and at this time it was not in bloom. TPB adults and nymphs were observed on the rye grass when the posttreatment samples were taken, at which time the rye grass was in bloom. Extra samples were taken on 10 May in the treated test area at Dunleith to estimate the abundance of rye grass. Rye grass averaged 50.1 seed or flower stalks per m^2 in 63 of these samples.

Treatment of cotton fields with insecticides and/or rain decreased the number of cotton fields sampled in some weeks in both years. In the week of 13-17 July 1998, no samples were taken because of heavy rain. Cotton fields in the check test area at Hollandale in the third week of June, and the treated test area fields at Dunleith in the 4th week of June in 1999, were not sampled because of widespread use of carbofuran for control of heavy cotton aphid, *Aphis gossypii* Glover, populations. Very low numbers of TPB were found in cotton during June through the 3rd week in July 1998 (Table 5). One main cause of the low numbers of TPB in cotton was treatment with insecticides for boll weevils in June in all of the test areas. Questionnaires on insecticide use were sent to 30 producers with cotton fields in the test areas in the fall of 1998. However, their response to these was very poor. Throughout the Delta of Mississippi an average of 3.3 insecticide applications for boll weevil control were estimated to have been made in 1998 (Williams 1999). TPB numbers in cotton in 1999 were low in the check and treated areas through most of June (Table 6). They began increasing in number in the two check areas in late-June and continued this increase through July. On 19 July (F = 2.54, df = 10, P = 0.04) and 26 July (F = 2.75, df = 10, P = 0.02) significantly more TPB were found in the check areas as compared to the treated areas. For the eight-week sample period an average of 0.056 TPB were found per sample in cotton in the treated areas, which was 3.2-fold lower than the average of 0.18 TPB per sample in cotton in the check areas.

Fall diapause applications of malathion for eradication of the boll weevil began in all four test areas in the 1st week of August 1999, and this terminated the experiment. A person was hired in 1999 who contacted growers in the four test areas each week to obtain insecticide use data. This data will be used by an economist to produce an economic analysis of the program. This analysis has not been completed.

Discussion

The first year of the experiment (1998) was a "learning year" in which we were unsure of several factors including how long it would take us perform the extensive pretreatment sampling, and how long it would take us to treat the broad leaf hosts in the marginal areas. Consequently, we ended up with only one treated test area in which only approximately 25% of the marginal areas with wild hosts were treated. We did treat all good stands of wild hosts in the area and this did

significantly reduce their numbers in these areas along with the numbers of TPB on them. Using our experience from 1998, we used two treated test areas in 1999 and treated a much higher percentage of the marginal areas with wild hosts (95% at Tribbett and 93% at Dunleith). Again we significantly reduced the numbers of wild hosts and caused a significant reduction in numbers of TPB found on them in the treated test areas as compared to the check test areas. However, in the treated test areas a significant increase in numbers of TPB was observed on the wild hosts from pretreatment numbers to posttreatment numbers. This increase was caused by TPB in the areas switching from broad leaf hosts (which were killed by the herbicide) to rye grass. Young (1986) listed 21 species of monocots that he found in the literature as hosts for TPB. Rye grass was not listed as a known host. However, it was blooming in late-April and May in the two test areas in which the broad leaf hosts were destroyed and TPB utilized it as a host. This is normal behavior for TPB who utilize most of their hosts only when flower buds are formed, or when flowers and developing seeds are present (Snodgrass et al. 1984). The one sample area that was mowed on 15 April 1998 had regrowth of many of the wild hosts when it was sampled on 12 May. To use mowing as a treatment, mowed areas will have to be checked and mowed again as needed. This was done in 1999 when the area mowed near a house was mowed in April and in May.

Treatment of the cotton fields in the four test areas with insecticides in 1998 for boll weevils resulted in very low numbers of TPB in the fields and no statistical analyses were possible. This may occur again in 2000 since all of the four test areas will be in the second year of boll weevil eradication in which several applications of malathion could be needed. This depends on how successful the fall diapause applications were in 1999, and how cold it gets in the Delta this winter. TPB did increase in number in the check test areas during the last two weeks in July 1999, and were significantly higher in the check as compared to the treated test areas. For all eight weeks that the fields were sampled, TPB were on average 3-times higher per sample in the check test area. The amount of decrease in numbers of TPB in the treated test areas which can be attributed to early season treatment of wild hosts will be difficult to determine. This will be partly dependent on insecticide use by growers in all four areas for TPB and other pests. This data is at present being summarized.

Trimec was used in the experiment because it does an excellent job in killing broad leaf plants, but does not kill grasses. Grasses could be important in controlling errosion and or in filtering chemical runoff from fields. In addition, they are hosts for aphids, thrips, and other insects which provide food for predaceous arthropods which can increase in number on them, and later move into crops. The use of rye grass as a host by the TPB presents a problem in reducing TPB numbers in the Trimec treated test areas. This problem can be solved by applying the herbicide treatment to the treated test areas at an earlier date. The TPB in the Delta in the winter of 1998 and 1999 broke reproductive diapause in mid- to late-December and began laying eggs in wild hosts which hatched in late-January (GLS, unpublished data). The F_1 nymphs became adults beginning in mid-March and this continued through April. Most overwintered adults were dead by the first week in May. If the herbicide is applied in the treated test areas in late-February and early March, the F_1 nymphs on the broad leaf wild hosts along with eggs laid in the hosts will be destroyed. Overwintering TPB adults will be forced from the area since no grasses are in bloom at this time. In 2000, the herbicide treatment will be applied in late-February and early-March and the results will be evaluated.

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Table 1. Wild host plant densities found in marginal areas by fields, roads, and ditches in two untreated test areas and in two test areas treated with a herbicide in late-March and early-April 1999.

	Mean number of wild hosts/ m^2			
	Pre-treatment	Post-treatment	Row ratio (pre/post trt)	Probability of sig.
Check test areas	23.5	16.7	1.41	<0.052
Treated test areas[a]	24.0	2.3	10.4	<0.001
Column ratio (check/trt)	0.97ns		7.3	<0.001

ns = not significantly different.

[a] The herbicide treatment in the treated areas was mecoprop + 2, 4-D + dicamba applied at 1.55 + 0.54 + 0.17 kg AI/ha, respectively.

Table 2. Most abundant broad leaf wild hosts found in marginal areas by fields, roads, and ditches in March, April and May in Washington and Sunflower Counties in Mississippi in 1998 and 1999.

Common name	Scientific name
Cutleaf geranium	*Geranium dissectum* L.
Calley-pea	*Lathyrus hirsutus* L.
Spotted burclover	*Medicago arabica* (L.) Hudson
White clover	*Trifolium repens* L.
Persian clover	*T. resupinatum* L.
Hop clover	*T. campestre* Schreber
Vetch	*Vicia angustifolia* Reichard
Sour dock	*Rumex crispus* L.
Daisy fleabane	*Erigeron philadelphicus* L.
Mayweed	*Anthemis cotula* L.
Henbit	*Lamium amplexicaule* L.
Sheperd's purse	*Capsella bursa-pastoris* (L.) Medicus
Cutleaf evening primrose	*Oenothera laciniata* Hill
Showy evening primrose	*O. speciosa* Nuttall

Table 3. Results from sweep net sampling of tarnished plant bugs on wild hosts 2-3 weeks after herbicide treatment, or from untreated wild hosts in the Delta of Mississippi in 1998.

	% of total no. of samples in each category			
	Sample category (mean no./sweep)			
Sample area	0.00	0.01-0.30	0.31-1.00	>1.00
Treated area (Tribbett)[a]	51.5	38.2	10.3	0.0
Check 1 (S of Tribbett)	4.7	37.5	31.3	26.6
Check 2 (Hollandale)	1.6	68.8	25.0	4.7
Check 3 (Kenlock)	1.9	65.4	25.0	7.7

The distribution of the samples in the four areas were significantly different (chi-square = 111.3, P = 0.001).

[a] The herbicide treatment in the treated area was mecoprop + 2, 4-D + dicamba applied at 1.55 + 0.54 + 0.17 kg AI/ha, respectively, during the 3rd and 4th weeks of April. A few small areas were spot-treated with glyphosate (0.2.2 kg AI/ha). Posttreatment samples were taken during the 2nd and 3rd weeks of May 1998.

Table 4. Results from sampling wild host plants for tarnished plant bugs prior to and after treatment with a herbicide, or untreated in the Delta of Mississippi in 1999.

	Mean number of tarnished plant bugs/sample			
	Pretrt	Posttrt	LSR* (rows)	P>T
Check areas	0.570	1.955	0.53	0.0001
Treated areas[a]	0.295	0.967	0.66	0.0002
Check vs treated:				
Pretreatment	0.570(ck)	0.295(trt)	1.212	0.1450
Posttreatment	1.955(ck)	0.967(trt)	1.502	0.0030

* LSR = Least Significant Ratio.

[a] The herbicide treatment was mecoprop + 2,4-D + dicamba applied at 1.55 + 0.54 + 0.17 kg AI/ha, respectively, applied during the 1st two weeks in April. Pretreatment counts were taken during the last week in March. Posttreatment counts were taken during the last week in April and 1st week in May.

Table 5. Results from sweep net sampling of cotton fields for tarnished plant bugs in an area of the Mississippi Delta near Tribbett in which good stands of wild host plants found in the area were treated with herbicides in April to reduce plant bug numbers, and in three areas in which the wild hosts were untreated in 1998.

	% of samples in cotton with no tarnished plant bugs		No. of samples	
Date	Treated area[a]	3 check area	Treated area	3 check areas
8-12 June	100.0	97.8	656	1431
15-19 June	95.7	98.5	419	1374
21-26 June	94.0	98.6	413	1220
29 June-3 July	96.5	97.4	398	876
6-10 July	89.4	93.9	322	1175
20-24 July	85.3	86.3	361	1075
27-31 July	80.8	85.5	348	1135
3-7 August	70.0	82.9	285	984

[a] The treated area received an application of herbicide (mecoprop + 2, 4-D, + dicamba at 1.55 + 0.54 + 0.17 kg AI/ha, respectively) during the 3rd and 4th weeks of April . A few areas were spot-treated with glyphosate (0.22kg AI/ha). Herbicides were applied to all areas with good stands of wild host plants.

Table 6. Mean numbers of tarnished plant bugs found in cotton in two areas of the Mississippi Delta in which good stands of wild host plants found in the areas were treated with a herbicide in April to reduce tarnished plant bug numbers, and in two areas in which the wild hosts were not treated in 1999.

	Mean number of tarnished plant bugs/ 10 sweeps								
	June				July				8 wk
	8	14	21	28	5	12	19*	26**	mean
Trt areas[a]	0.059	0.083	0.010	0.004	0.043	0.126	0.038	0.087	0.056
Chk areas	0.065	0.083	0.028	0.113	0.190	0.229	0.295	0.434	0.180

* Mean comparison between the check and treated areas was significantly different P = 0.04; ** significantly different P = 0.02.

[a] The treated areas received an application of mecoprop + 2, 4-D + dicamba at 1.55 + 0.54 + 0.17 kg AI/ha.