



In this April issue of the Postings from the Palo Verde I include recent research done in cotton for Brown stink bug management.

- **Chemical Efficacy Trial using Select Insecticides against Brown stink bug, *Euschistus servus* on Commercially Planted Cotton** – Vonny Barlow, University of California, Agricultural and Natural Resources, Riverside County

Regards:

A handwritten signature in black ink that reads 'Vonny M. Barlow'. The signature is written in a cursive, flowing style.

Vonny M. Barlow, Ph.D.

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**Chemical Efficacy Trial using Select Insecticides against Brown stink bug,  
*Euschistus servus* on Commercially Planted Cotton**

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**ABSTRACT**

As plants senesce or are harvested, numbers of Brown stink bug, *Euschistus servus* migrate from crops that act as host plants, such as; shrubs, many broadleaf weeds, corn, soybean, sorghum, millet, snap beans, into nearby susceptible crops (e.g. Cotton). The presence of host crops in close proximity to susceptible crops increases the difficulty of managing Brown stink bugs in cotton. Use of a 20% threshold for prophylactic insecticide treatments against emigrating *E. servus* from nearby crop fields did not significantly reduce population of *E. servus* adults within treatments compared to the untreated controls. This study demonstrated that there was not a significant relationship between *E. servus* feeding x boll rotting pathogen x cotton boll rot which is prevalent in the South-eastern US. This suggests that the paradigm (*E. servus* x boll rotting pathogen x cotton boll rot) may not be present in California's southern desert where the Palo Verde Valley is located. This along with the lack of significant differences of HVI color classing among the treatments suggests that damage done by *E. servus* in Southern California is limited to direct damage by the insect feeding itself and not plant pathogens introduced by *E. servus* feeding. The usefulness of chemical treatments is dependent on the assessment of the utility of such treatments. It appears that the use indirect assessment of *E. servus* activity by "cracking" bolls is not a useful tool for determination of chemical application timing. Use of weep net sampling has to be improved/modified to reflect the utility of treatments and can be problematic given the cryptic nature of *E. servus* in the cotton canopy.

**THE OBJECTIVE**

Assess the efficacy of selected insecticides for management of the invasive Brown stink bug, *Euschistus servus* on cotton.

**INTRODUCTION**

As plants senesce or are harvested, numbers of Brown stink bug, *Euschistus servus* (**Fig. 1a**) will migrate from crops that act as host plants, such as; shrubs, vines, many broadleaf weeds, legumes, corn, soybean, sorghum, okra, millet, snap beans, peas, into nearby susceptible crops such as cotton. The presence of host crops in close proximity to susceptible crops (e.g. cotton) increases the difficulty of managing Brown stink bugs in cotton. Repeated insecticide applications, necessitated by migration from host crops, are not only costly, but increase the possibility of secondary pest outbreaks. Brown stink bugs can be found across all of southern Canada, much of North America and often throughout the year in parts of the southern U.S. *Euschistus servus* occurs throughout North America with two subspecies. *Euschistus s. servus* (Say) occurs throughout the southeastern U.S. from Florida through Louisiana to California, *E. s. euschistoides* (Voltenhoven) occurs across Canada and the northern U.S.

In 2013, damage to cotton (**Fig. 1b&c**) from *E. servus* resulted in a 25-30% yield reduction which required repeated pesticide applications. Typical cotton insecticide applications in Southern California range from 3 – 4 applications. However, in 2013, infestations of cotton by the Sweetpotato Whitefly Biotype B, *Bemisia tabaci* (Gennadius) and *E. servus* resulted in greater than \$350.00/A for control costs over the period of Aug. 1 – Oct. 1 (personal communication). To better implement an area-wide integrated pest management (IPM) program for *E. servus*, more information is needed concerning the influence that host crops have on *E. servus* populations. Insects are known to have directed movement towards preferred host plants Stink bugs will often leave a host within 24 hours after the field is harvested or senesces. Harvest of nearby crops creates this condition. The use of chemical insecticides can help to mitigate movement of *E. servus* into cotton.

## MATERIALS & METHODS

A commercial cotton field planted with cv. ‘Phytogen 375 WRF’ round-up ready cotton was selected with alfalfa fields adjacent on two sides prior to establishment of experimental plots. The experiment consisted of a large scale replicated ( $n = 3$ ) randomized complete block design with eight individual treatments with each replicate consisting of 6 rows that were 349.3 m long ( $\approx 0.65$  ha total) (**Fig. 2**). All treatments received an initial application of material(s) on 7/14/2015 following the recommended labeled rate(s) (**Table 1**). Follow-up applications were applied when internal cotton bolls were determined to possess 20% or greater internal cotton boll warts in individual treatments (**Fig. 1b, Table 1**). Approximately 7d after the initial main-plot treatments were made (7/22/2015) weekly sampling began (**Fig. 3**). Sampling consisted of 50 sweeps taken per six-row treatment with a standard University of California sweep net (0.37 m diameter), for a total of 150 sweeps per treatment. Sweep net contents were immediately transferred into individual 3.8 L plastic bags and placed in a cooled ice chest. Samples were processed afterwards by first freezing the bags and their contents and then hand sorting by insect type (**Fig. 4a**). Numbers of *E. servus* were then totaled and averaged to produce the mean abundance of *E. servus* per treatment over time (**Fig. 5**). Assessing damage by *E. servus* done to cotton bolls was used as a way of indirectly assessing presence of *E. servus* in treatments. Twenty cotton bolls (2.29 – 2.79 cm diam.) were collected weekly per replicated plots. Cotton bolls from each treatment were immediately transferred into individual 3.8 L plastic bags and placed in a cooled ice chest. Samples were destructively processed afterwards to determine cotton boll damage caused by *E. servus*; external feeding punctures, internal feeding punctures, stained cotton lint and boll rot (**Fig. 4b&c**). Cotton yield was determined at the end of the season by harvesting individual treatments of 6 rows and individually weighing using a weigh basket “boll buggy” fitted with a digital scale. Assessment of cotton lint quality/treatment was done by small batch ginning 90 – 100 g of cotton lint for HVI color classification. Data was analyzed using a mixed model with  $P < 0.05$  level of significance to analyze potential treatment differences in mean abundance of *E. servus* abundance and yield at end of season harvest.

## RESULTS

Use of a 20% threshold for prophylactic insecticide treatments against emigrating *E. servus* from nearby crop fields did not significantly reduce population of *E. servus* adults within treatments compared to the untreated controls ( $df = 7, P = 0.16$ ) (**Fig. 5**). Evaluation of treatments from destructively sampling cotton bolls ( $n = 6,720$ ) independently showed that there was no significant difference in treatments when comparing presence/absence of internal cotton boll warts ( $df = 12, P = 0.46$ ) compared to all other treatments (**Fig. 6**). Evaluation of treatments showed that there was no significant difference in treatments when comparing presence/absence of cotton boll punctures (externally or internal) from *E. servus* feeding ( $df = 7, P = 0.09$  and  $df = 7, P = 0.51$  respectively) compared to all other treatments (**Fig. 6**). Evaluation of treatments showed that there was no significant difference in treatments when comparing presence/absence of internal cotton boll lint/seed staining or internal cotton boll lint/seed rot from *E. servus* feeding ( $df = 7, P = 0.54$  and  $df = 7, P = 0.07$  respectively) compared to all other treatments (**Fig. 6**). Cotton boll rot which is often associated with presence of cotton boll warts (warts X boll rot) was not found significant ( $df = 16, P = 0.66$ ) (**Fig. 5**). End of season boll maturation to harvestable cotton lint showed that treatments did not produce significantly more cotton (Lbs.) compared to the untreated controls ( $df = 7, P = 0.96$ ) (**Fig. 6**). Evaluation of cotton (HVI color classification) lint quality/treatment was not classified significantly different when compared to the untreated controls ( $df = 7, P = 0.57$ ) (**Fig. 7**).

## DISCUSSION

The work presented here demonstrated that the use of the selected insecticides for *E. servus* management failed to reduce populations compared to the untreated controls (**Fig. 5**). The use of large plot studies was hoped to maximize treatment differences and to minimize the effect of insect movement between treatments when compared to small plot trials. Although there were products included in this trial that have performed well in the South-eastern US (e.g. Bidren 8, Vydate, Acephate + Baythroid). The failure in expected performance by the selected chemistries used in this trial was most likely the result of depending on a 20% threshold for internal cotton boll warts as the “trigger” for chemical applications. The use of the 20% threshold for internal cotton boll warts as used by researcher(s) in Arizona and the South-eastern US including North Carolina, South Carolina, Georgia and Florida was considered as a useful “working” threshold. It became evident that there appeared to be a disconnection between the use of a 20%

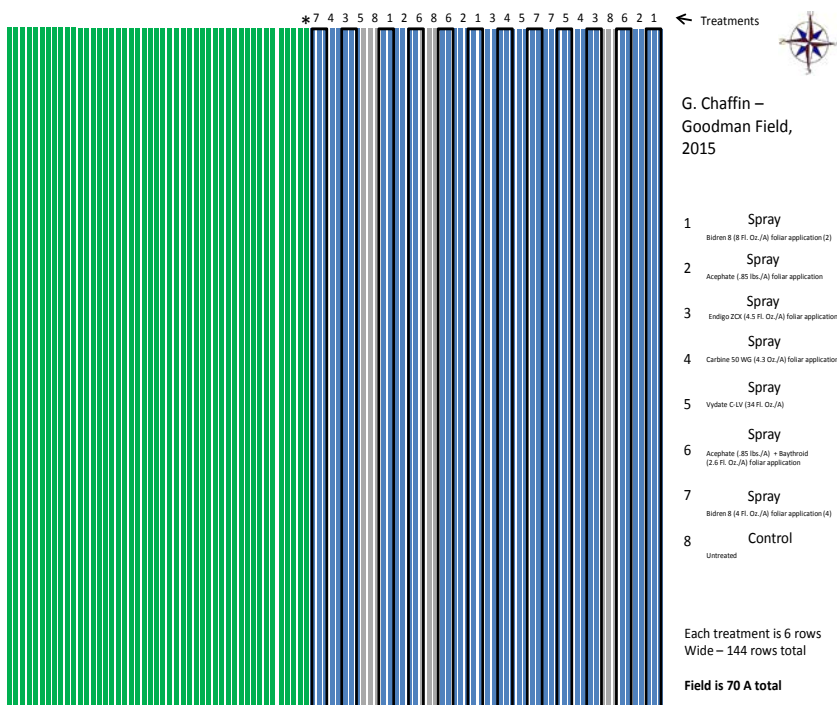
threshold for internal cotton boll warts as an indicator for treatment and the feeding by *E. servus* and resultant cotton boll rot. In fact, there was only a short period of time that cotton bolls in the untreated controls exhibited greater presence of internal cotton boll warts (**Fig. 6, shaded area**) compared to other treatments. This study demonstrated that there was not a significant relationship between *E. servus* feeding x boll rotting pathogen x cotton boll rot which is prevalent in the South-eastern US (**Figs. 5 & 6**). Another *E. servus* trial run simultaneously (2015) to the one detailed here also showed the same lack of cotton boll rot associated with *E. servus* feeding. This may be the result of little to no cotton boll rotting inoculum being present or that environmental conditions on the cotton leaf surface may not be able to support boll rotting inoculum (or both). Prior research indicates that 5% of cotton bolls will succumb to cotton boll rot for unknown reasons. If we are not seeing increased cotton boll rot in the untreated controls in this trial this may suggest that the paradigm (*E. servus* x boll rotting pathogen x cotton boll rot) may not be present in California's southern desert where the Palo Verde Valley is located. In the South-eastern US including North Carolina, South Carolina, Georgia and Florida you can normally expect to find up to 35% cotton boll rot in chemically unprotected cotton (**Fig. 5**). This along with the lack of significant differences of HVI color classing among the treatments (**Fig. 7**) suggests that damage done by *E. servus* in Southern California is limited to direct damage by the insect feeding itself and not plant pathogens introduced by *E. servus* feeding. The usefulness of chemical treatments is dependent on the assessment of the utility of such treatments. It appears that the use indirect assessment of *E. servus* activity by "cracking" bolls is not a useful tool for determination of chemical application timing. Use of weep net sampling has to be further investigated for its utility to reflect usefulness of treatments and can be problematic given the cryptic nature of *E. servus* in the cotton canopy.

## ACKNOWLEDGMENTS

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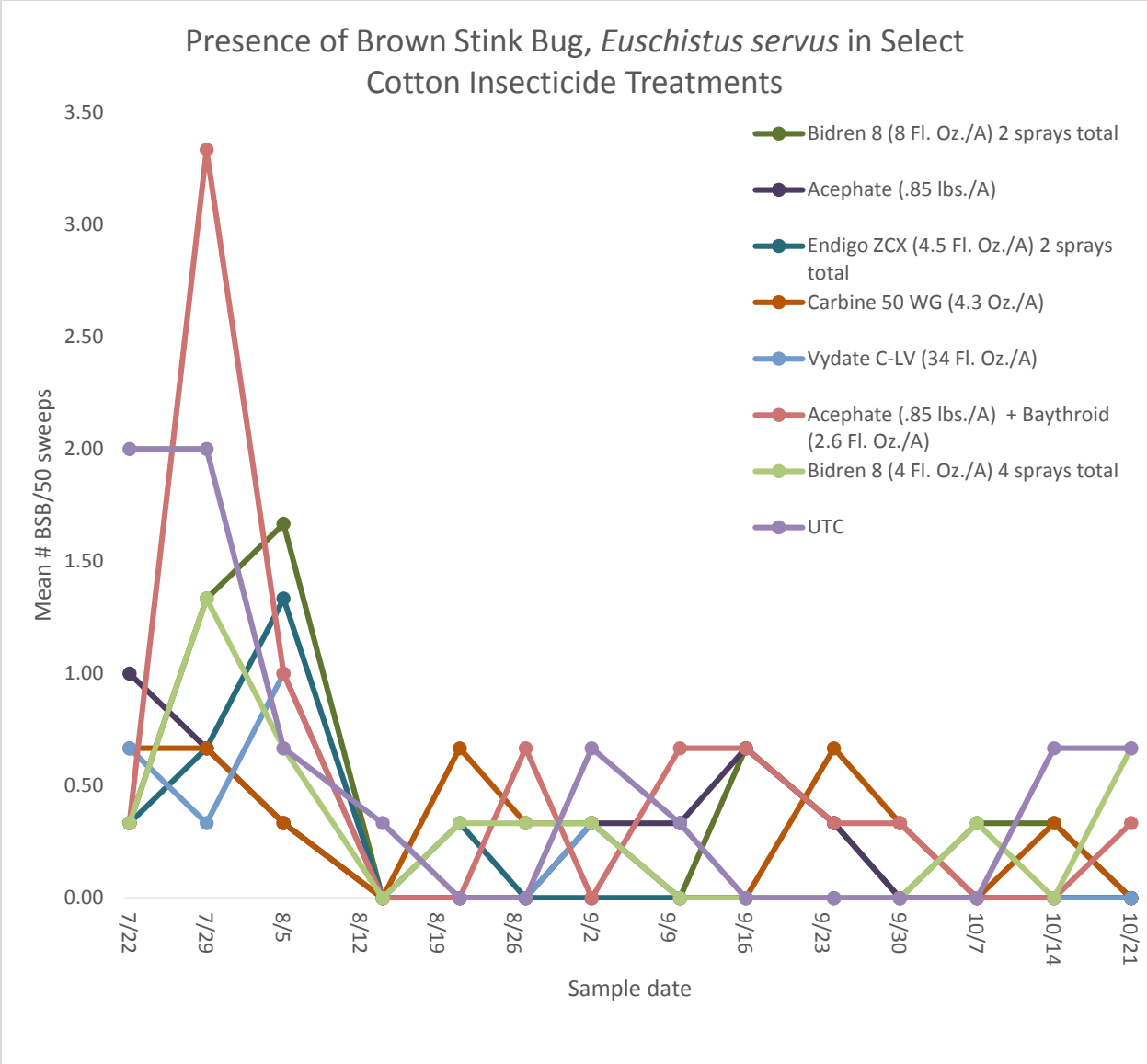
**Fig. 1 Brown stink bug feeding damage in cotton; a, *Euschistus servus*, b, Damaged cotton bolls showing internal feeding punctures and “warts” c, Damaged cotton bolls showing boll rot and stained seeds**



**Fig. 3 Assessing for damaged cotton bolls showing internal feeding punctures, internal warts, boll rot and/or stained seeds**



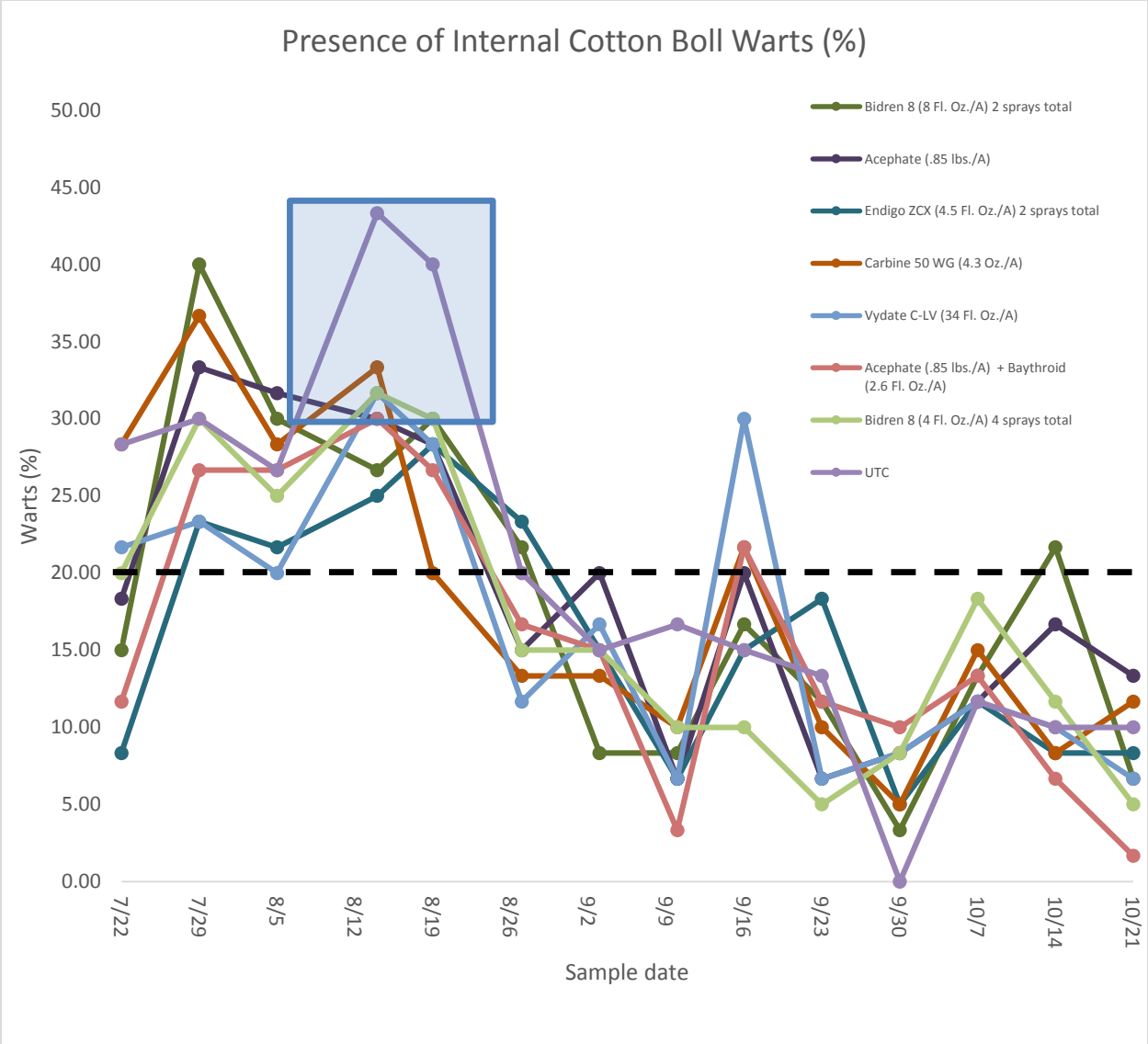
**Fig. 4 Brown stink bug feeding damage in cotton; a, *Euschistus servus* collected from sweep sampling, b, Damaged cotton bolls showing stained cotton lint surrounding seeds c, Damaged cotton bolls showing undamaged cotton lint and seeds**



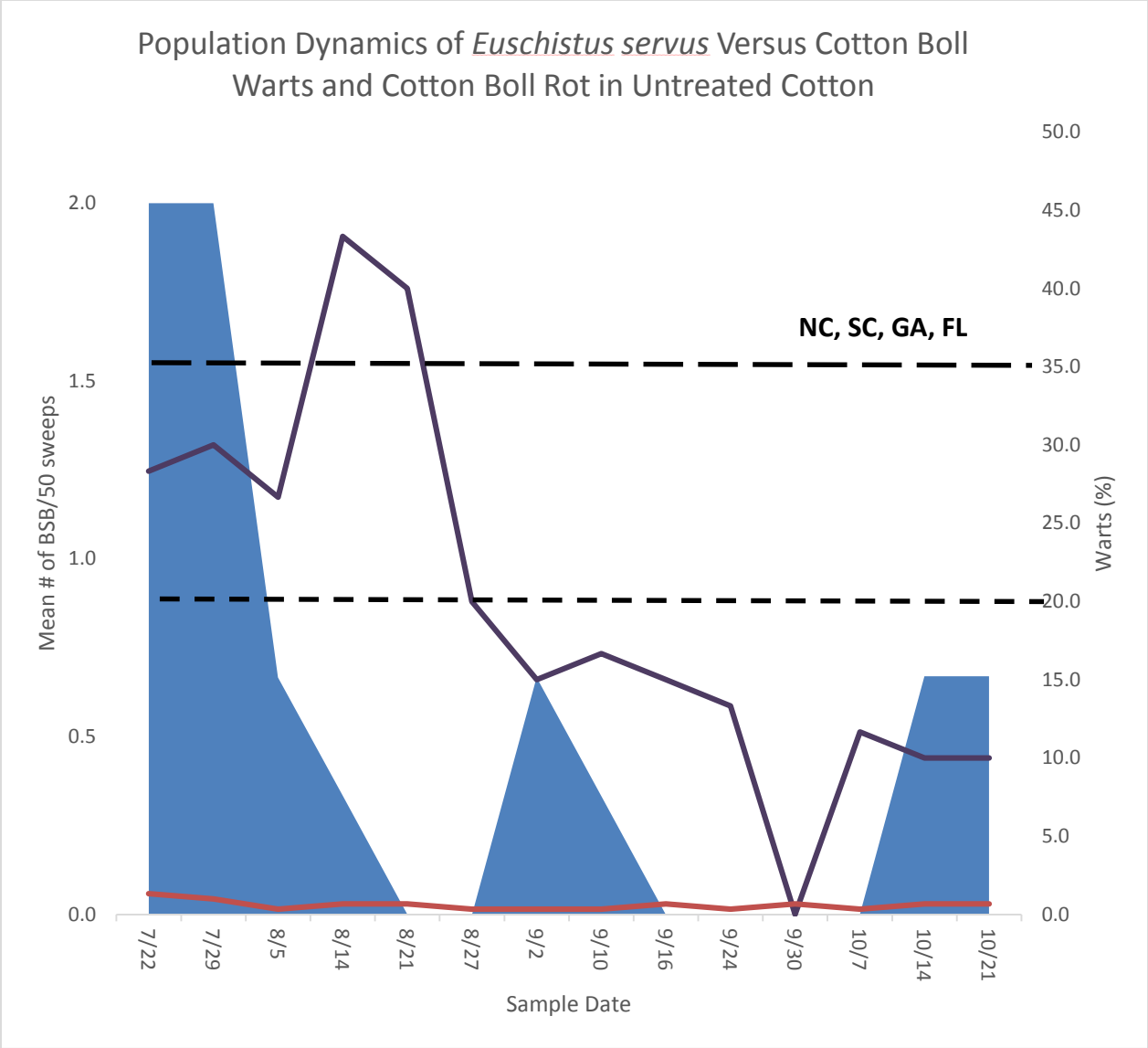
**Fig. 5** Populations of *Euschistus servus* over time in selected insecticide treatments versus untreated controls on commercially planted cotton

**Table 1.** Brown stink bug, chemical application dates, *Euschistus servus* counts ( $\pm$ SE). Blythe CA 2015.

Mean Brown stink bug counts $\pm$ SE			
Cultivar	n	Application date	# <i>Euschistus servus</i>
<b>PhytoGen 375 WRF</b>			
1 – Bidren 8 (8 fl. Oz./A)	42	7/14, 8/14	0.36 $\pm$ 0.11a
2 – Acephate (.85 lbs./A)	42	7/14, 8/14	0.26 $\pm$ 0.08a
3 – Endigo (4.5 fl. Oz./A)	42	7/14, 8/14	0.19 $\pm$ 0.10a
4 – Carbine (4.3 Oz./A)	42	7/14, 7/29, 8/14	0.31 $\pm$ 0.10a
5 – Vydate (34 fl. Oz./A)	42	7/14, 7/29, 8/14	0.17 $\pm$ 0.09a
6 – Acephate (.85 lbs./A) + Baythroid (2.5 fl. Oz./A)	42	7/14, 8/14	0.55 $\pm$ 0.17a
7 – Bidren (4 fl. Oz./A)	42	7/14, 7/29, 8/14	0.31 $\pm$ 0.09a
8 – Untreated control	42	No treatments	0.52 $\pm$ 0.13a

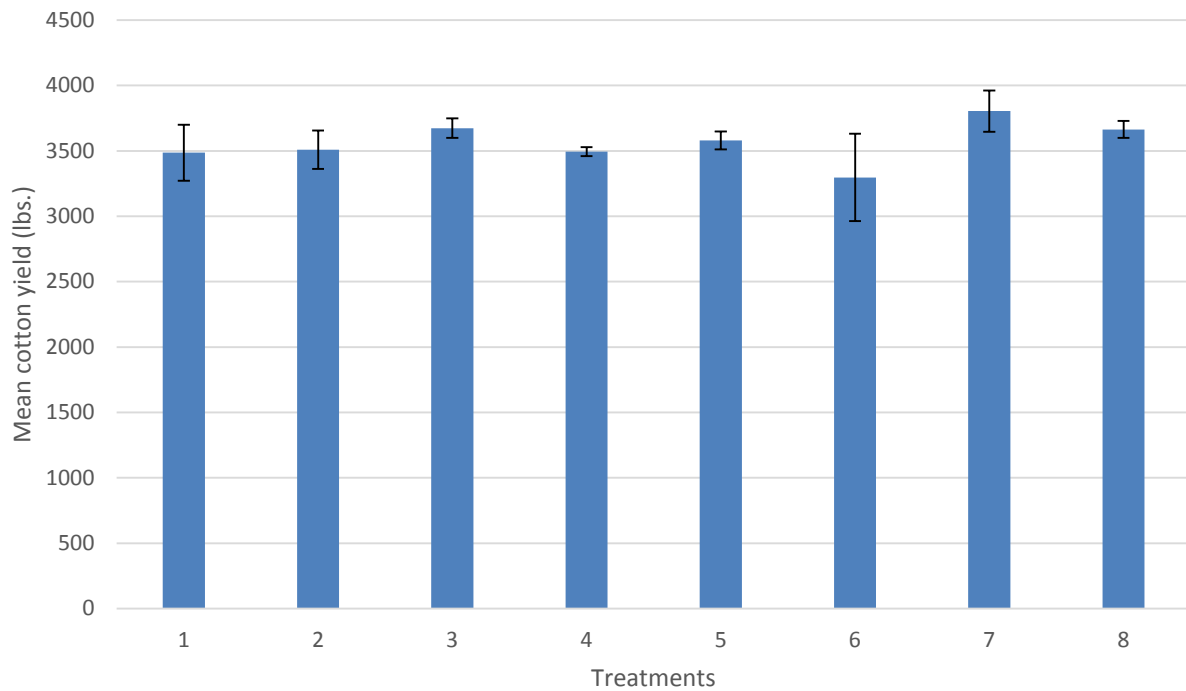


**Fig. 6** Presence of internal cotton boll warts over time in select insecticide treatments against *Euschistus servus* in commercially grown cotton. Shaded area indicates when control treatments showed internal boll warts over the 20% threshold



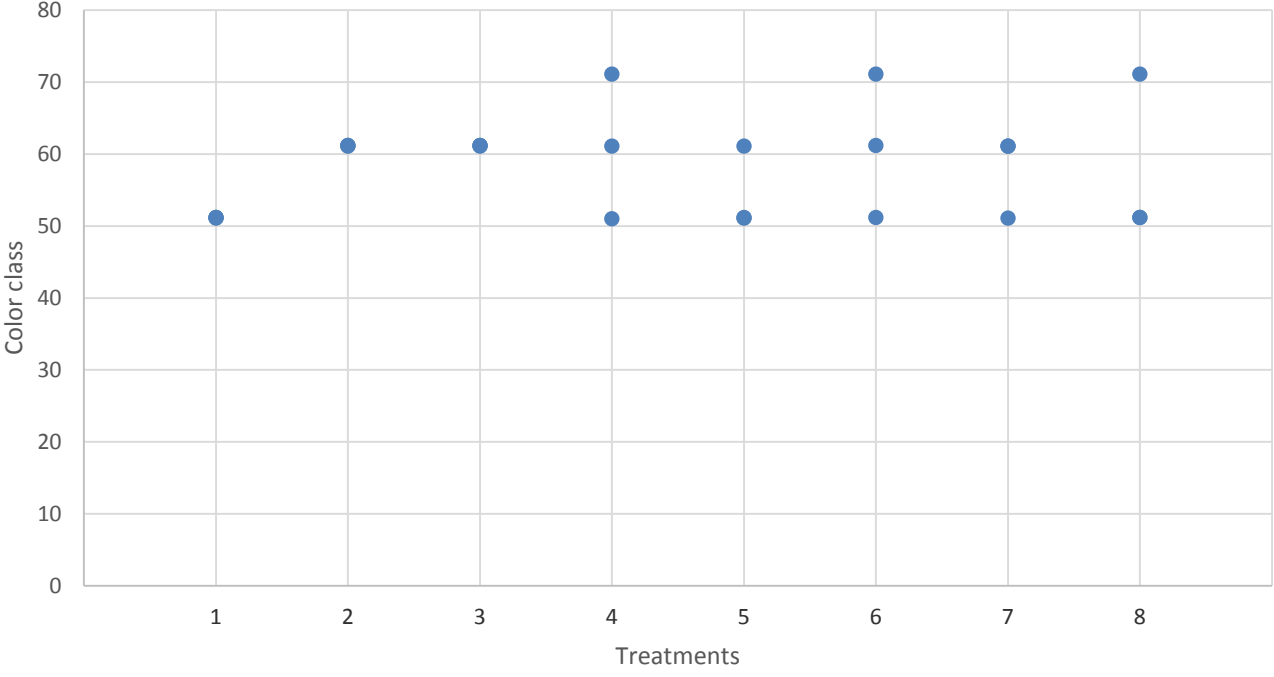
**Fig. 5** Populations of *Euschistus servus* over time in untreated commercially grown cotton versus presence of internal cotton boll warts and/or cotton boll rot

## Cotton Yield Associated with Selected Insecticide Use Against the Brown stink bug, *Euschistus servus* in Cotton



**Fig. 6** End of season cotton yield ( $\pm$ SEM) associated with selected insecticide use against the brown stink bug, *Euschistus servus* in commercially grown cotton

### Comparison of Cotton Lint Color Classes Associated with Selected Insecticide Use Against the Brown stink bug, *Euschistus servus* in Cotton



**Fig. 7** End of season cotton yield cotton lint color (HVI) classes associated with selected insecticide use against the brown stink bug, *Euschistus servus* in commercially grown cotton.

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