POTENTIAL FOR USING BOLL DAMAGE AS A THRESHOLD INDICATOR FOR LYGUS IN THE TEXAS HIGH PLAINS

Dustin Patman
David Kerns
Brant Baugh
Texas AgriLife Extension Service, Texas A&M System
Lubbock County, Texas

Abstract

Western tarnished plant bugs in the Texas High Plains are usually most severe during late season development of the last harvestable bolls. However, cotton can suffer significant yield loss from Lygus feeding during this period. Our data supports the current action threshold, during this developmental time period, of 4 Lygus per 6 ft-row using the drop cloth sampling method. However, sampling tall cotton with a heavy boll load with a drop cloth is difficult. Using boll damage as a threshold in addition to the presence of Lygus may be an easier and faster sampling method. Based on dime size bolls, our data suggests that 67 internally damaged locules, or 400 external stings per 100 bolls are consistent with the threshold of 4 Lygus per 6 ft-row. The boll damage method has potential utility as a Lygus action threshold.

Introduction

Western tarnished plant bug, *Lygus hesperus,* in the Texas High Plains, has the potential to cause significant boll damage in late season cotton resulting in reduced yield and fiber quality. The feeding of Lygus on cotton bolls is characterized by dark necrotic spots that are about 2-mm in width with a sunken center. The injury to the bolls may be external (superficial) or internal depending on the maturity/age of the bolls. Cotton bolls that are < 200 heat units (>60 ^{o}F) old are most susceptible to Lygus damage, but bolls remain susceptible to internal damage up to 350 heat units of age.

When Lygus feed on developing bolls, they are primarily targeting the seed. Successful carpal wall penetration may result in smaller seed. More importantly, effected seed may not produce as much lint; thus affecting yield. Additionally, bolls suffering internal damage from Lygus feeding may abscise, leading to further yield reduction. Lygus feeding may also result in stained lint, or can allow access to boll rotting organisms.

Currently, the recommended technique for sampling Lygus in cotton during boll filling is the drop cloth method. Although this technique does appear to be reliable, it is often difficult to use in cotton that is tall, and/or has a heavy boll load. Consultants have expressed dislike for this sampling technique during mid to late boll filling and have expressed interest in an action threshold based on boll damage with the presence of Lygus.

The objectives of this study were to investigate the relationships between Lygus density, damage and yield, and to determine the possibility of developing an action threshold based on damage.

Materials and Methods

The data presented were collected from four irrigated cotton fields in the Texas High Plains in 2008-2010. All test sites consisted of insecticide efficacy tests in cotton that were beyond cutout, with the nodes above white flower = 2-4. Thus, all of the yield loss associated with these sites was the result of Lygus feeding on bolls rather than squares.

All test sites were RCB designs with 4 replicates. Plots were 4 rows X 60 ft in length. The Lygus population at each site was estimated by the drop cloth method (3 ft x 2 ft) and expressed as mean density/6 ft-row. The Lygus populations at all locations were predominately nymphs and counts were made at 0, 7, 14 and 21 DAT. To assess boll damage, 10-15 dime size bolls that were approximately 15 to 20-mm diameter (~150 to 200 HU maturity) were collected at random from each plot for damage assessment at 0 and 7 DAT. Ten to fifteen bolls were collected, sealed in Ziploc bags and stored in a refrigerator until damage observations could be made.

The external damage assessment was made by counting the number of feeding punctures using a 10x magnifying lens. For internal damage, bolls were cut cross sectional with two cuts, one at about one-third and one at two-thirds of the distance from the tip. The number of damaged locules were counted and recorded as internal damage.

In 2008 and 2009, three of the tests had their plots harvested using a 28” hand basket stripper. Six samples were pulled from the middle two rows of each plot totaling 1/1000 acre. The 2010 test site had each plot harvested in its entirety using a mechanized cotton stripper. All harvest samples were ginned at the Texas AgriLife Ginning Facility in Lubbock.

In order to produce more data points, data from all four locations were pooled for analysis and the yields were normalized by converting the yields at each site into a proportion of the highest yielding plot. For correlation purposes, data from the 7 DAT evaluations and yield (lint-lbs per acre) were used for analysis. Beyond seven days, the Lygus populations at all sites did not return and should not have impacted our results. Data were analyzed using simple linear regression models (Sigma Plot 10, Systat Software Inc, 2006).

Results and Discussion

The current action threshold for Lygus on cotton after peak bloom is 4 per 6 ft-row. However, this threshold was developed prior to cutout and represents damage associated primarily with square feeding. It is not known whether this threshold fits cotton that has reached cutout, when damage is solely from boll feeding.

Table 1. Texas action threshold for lygus damage.

	Sampling method*	
Cotton stage	**Drop cloth**	**Sweep net**
1st two weeks of squaring	1-2 per 6 ft-row with unacceptable square set	8 per 100 sweeps with unacceptable square set
3rd week of squaring to 1st bloom	2 per 6 ft-row with unacceptable square set	15 per 100 sweeps with unacceptable square set
After peak bloom	4 per 6 ft-row with unacceptable fruit set the first 4-5 weeks	15- 20 per 100 sweeps with unacceptable fruit set first 4-5 weeks

*Sweep net – standard 15-inch net, sample 1-row at a time taking 15-25 sweeps. Recommended before peak bloom.

Drop cloth – black is recommended; 3-ft sampling area, sample 2-rows. Recommended after peak bloom.

Cease sampling and treating when NAWF = 5+ 350 DD60's.

Based on our test sites, yield was negatively correlated with Lygus density (Figure 1). Although the *P*-value was significant at 0.01, the R^2 value was relatively low, accounting for only 23% of the differences in yield. The reason for the low R^2 value is undoubtedly the variability in yield when Lygus densities were less than 1 per 6 ft-row. Additionally, because we are pooling data from four locations over a three year period, variability in data is expected. Thus, the low R^2 value is not necessarily indicative of a weak relationship.

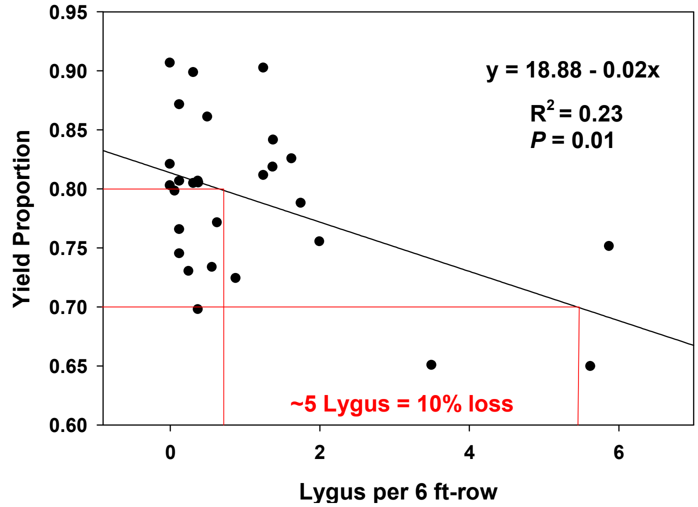

Figure 1. Linear relationship between yield and Lygus density.

Using this linear relationship, we can determine the approximate number of Lygus necessary to cause various degrees of associated yield loss. Using our model, and a 10% yield reduction as the initial point of unacceptable yield loss, we find that we can tolerate no more than approximately 5 Lygus per 6 ft-row. Thus, our current threshold appears to be acceptable. However, much more data needs to be added to the model to strengthen it and increase the R^2 value.

Lygus feeding on bolls results in external feeding injury or stings. However, not all stings result in boll damage, and it is internal boll damage that is of economic concern. Because of the difficulty of utilizing drop cloth or sweep net samples to estimate late season Lygus populations, many consultants have stated that they would prefer a Lygus action threshold based on damage. Also, due to the timeliness associated with boll dissection for internal damage, there is much interest in a threshold based on external stings, which are quick and easy to assess.

Before we can utilize a threshold based on external stings, we must first understand the linear relationship between external and internal damage to bolls that measure 15-20 mm in diameter (target size of the bolls to sample). As expected, there is a close relationship between external and internal injury (Figure 2). Based on this model, it appears that approximately 16% of external stings result in a damaged locule.

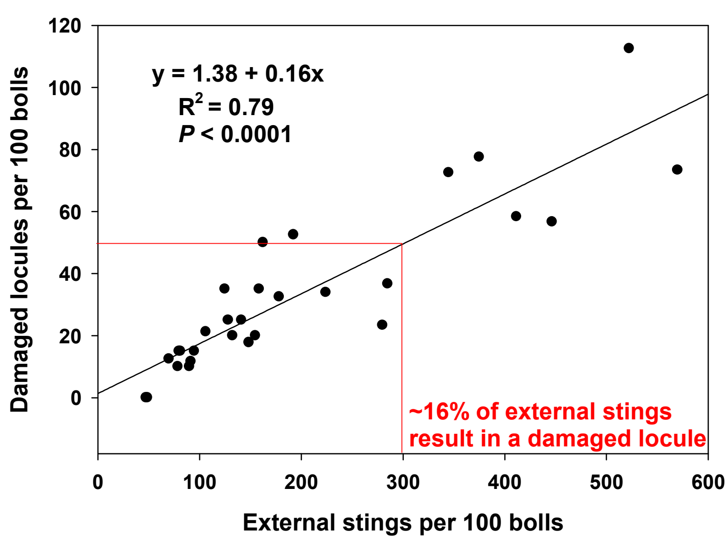

Figure 2. Relationship between the external and internal Lygus damage to dime sized (15-20 mm diameter) bolls.

Internal boll damage was correlated with Lygus density (Figure 3A). Using our current action threshold of 4 Lygus per 6 ft-row, we can estimate that an insecticide application is justified if 67 damaged locules are detected per 100 bolls along with the presence of Lygus. Similarly, based on external stings, we can deduce that if 400 or more external stings are detected per 100 bolls, along with the presence of Lygus, an insecticide application is justified (Figure 3B). The number of external stings needed to trigger an insecticide application in this experiment, based on the relationship between external stings and internal damage (16% of stings result in a damaged locule) (Figure 2), equals 418 external stings.

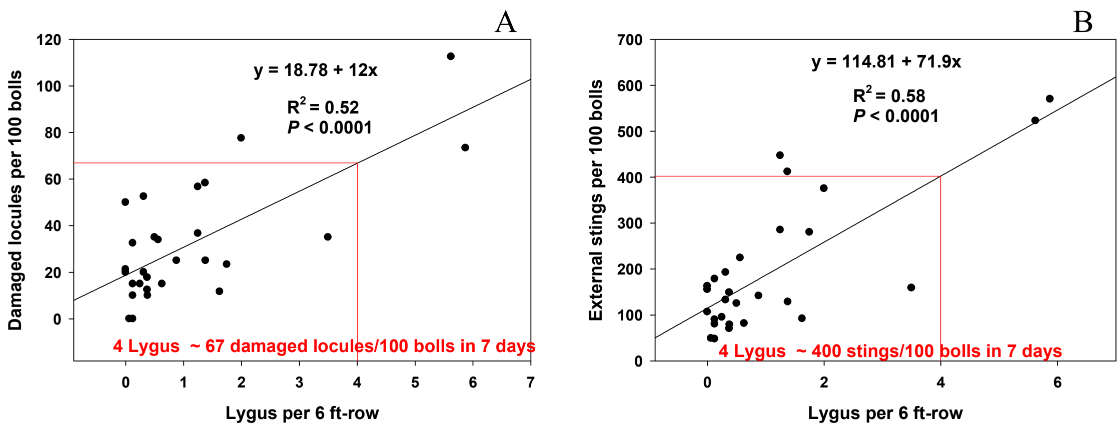

Figure 3. (A) Relationship between damaged locules and Lygus density (B) relationship between external stings and Lygus density.

Based on the above relationships, it appears that 67 internal damaged locules, or 400 external stings, per 100 dime to nickel size bolls along with the presence of Lygus, may be a viable action threshold. However, more data is needed to strengthen these models, especially the relationship between Lygus density and yield production.

Summary

These data support the current action threshold during this developmental time period of 4 Lygus per 6 ft-row using the drop cloth sampling method. Based on dime size bolls, our data suggests that 67 internally damaged locules, or 400 external stings per 100 bolls, is correlated with the threshold of 4 Lygus per 6 ft-row and has potential utility as a Lygus action threshold. More data is required for confirmation.

Acknowledgements

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