MODIFIED FIELD-CAGE STUDY TO ESTIMATE *LYGUS* TREATMENT THRESHOLDS IN TEXAS COTTON

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Abstract

A field study was conducted to generate data relevant to developing economic threshold-based management recommendations for *Lygus hesperus* in Texas High Plains cotton. Cotton plants were caged and exposed to five levels of *Lygus* (0, 1, 2, 4 and 6 adults per plant) for one week at 200, 350 and 550 HU after first flowering. One week after *Lygus* releases, cages were removed, harvested one plant from each cage for damage assessment, and sprayed the remaining crop to keep the maturing bolls free from further insect infestations. Higher *Lygus* densities caused greater boll damage as evidenced by more external lesions and internal warts compared to that for lower *Lygus* densities or control cages. Cotton compensated the early season *Lygus*-induced fruit loss, whereas mid-season infestations caused the greatest lint yield reduction. *Lygus* treatment threshold for early-season bolls would be twice the infestation level of our current threshold and up to three times for late season infestations.

Introduction

Texas is the leading cotton, *Gossypium hirsutum* L., growing state within the United States, with approximately 5 million acres (55% of U.S. cotton production) planted in recent years. *Lygus hesperus* is an emerging pest of cotton in the Texas High Plains. In 2013, an overall 2.55% reduction in U.S. cotton fiber yield was attributed to arthropod pests while 0.83% was due solely to *Lygus* species, which was ranked top among other yield-reducing pests (Williams 2014). Both adult and nymphal stages of *Lygus* can cause damage to fruiting cotton. Late-instar *Lygus* nymphs can cause greater damage to the young bolls than adults (Jubb and Carruth 1971, Parajulee et al. 2011).

As boll maturity profiles change, *Lygus* boll selection and feeding behavior may also change which can result in different levels of crop injury and yield loss. There is a strong relationship between boll maturity and *Lygus* feeding damage, thus understanding the boll maturity profile and characterizing *Lygus* damage risk dynamics is a necessary prerequisite for developing treatment thresholds. Current pesticide application decisions are based on field scouting, whereby spray applications are typically warranted when *Lygus* populations exceed present economic threshold levels. Generally, cotton bolls that accumulated 350 heat units are safe from piercing-sucking insects. The effect of *Lygus* feeding injuries during early, mid, and late season on lint yield is not clearly understood. The objectives of this experiment were to determine the effect of *Lygus* feeding on lint yield at three crop development stages, 200, 350 and 550 HU (>60 ºF) after first flowering.

Materials and Methods

A field study was conducted at the Texas A&M AgriLife Research and Extension Center farm located near Lubbock, Texas to develop economic threshold-based management recommendations for *Lygus hesperus*, a mid-season pest of Texas High Plains cotton (Fig. 1). Cotton cultivar ST 4946 GLB2 was planted in a field with 40-inch row spacing. The targeted seeding rate was 40,000 seeds per acre. Standard agronomic practices for the Texas High Plains were used. Multi-plant cages were used to accommodate approximately 12 plants within the cage and the cage served as a replication. This study was laid out in a split-plot randomized block design with four replications, three main plot factors (three cotton boll developmental stages [early, mid, and late boll development]), and five subplot factors (five levels of *Lygus* infestation [control or zero bugs, one bug/plant, two bugs/plant, four bugs/plant, and six bugs/plant]). Cage locations were marked on July 27 when 50% of the plants within the uniform stand had their first white flower. The heat unit accumulations were estimated from that point forward. Cages were installed and *Lygus* density treatments were deployed at 200, 350 and 550 HU accumulations. Cages were removed one week after actual releases and we harvested one plant from each cage to estimate *Lygus* damage on bolls. After the cages were removed,

Orthene® 97UP insecticide was sprayed to maintain the experimental row-sections of the field insect-free for the remainder of the growing season. Plant mapping was done before harvest. Bolls were hand-harvested and ginned using a table-top laboratory gin for lint and seed estimation.

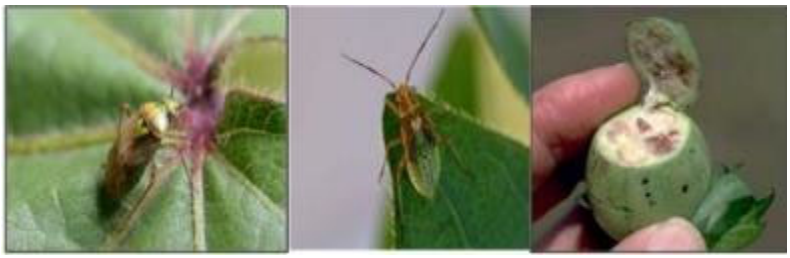

Figure 1. *Lygus* adult (left); nymph (middle); and infested boll (right).

Results and Discussion

Feeding marks are indicators of *Lygus* infestation and injury. External feeding mark (sunken lesions on the external surface of the boll) numbers were considerably higher in early season bolls compared to that in late season. Number of external lesions per boll increased with increased *Lygus* density, which is especially pronounced during the early season period (Fig. 2). Four *Lygus* per plant caused significantly higher external lesions compared to the control and the 1 and 2 *Lygus* per plant treatments; however, increasing the density to six *Lygus* per plant did not increase the external feeding injury marks (Fig. 2). Our previous study suggested that the survivorship of the field-collected and cage-released *Lygus* adults in the Texas High Plains is about 20-25%. Therefore, our highest actual density was set around 1-1.5 bugs per plant.

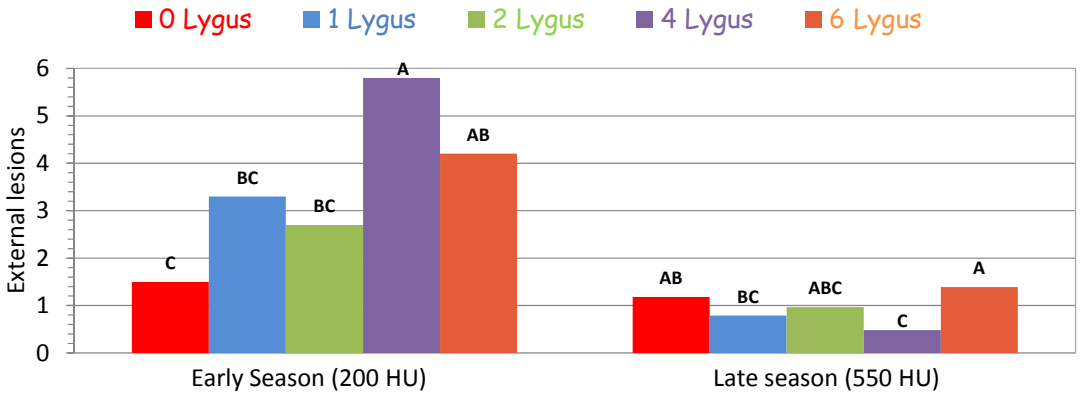

Figure 2. Cotton boll external injury (external lesions) at two phenological stages of cotton following a 7-day exposure of various densities of *Lygus* adults in multi-plant cages, Lubbock, TX, 2015.

Internal injury followed the similar trend as for external lesions, with an increased number of internal injury warts as *Lygus* densities increased. Regardless of the crop's phenological stages, *Lygus* caused internal injuries to the bolls compared to that in control cages. However, a density-dependent relationship between *Lygus* density and internal boll damage was more evident in late season (Fig. 3).

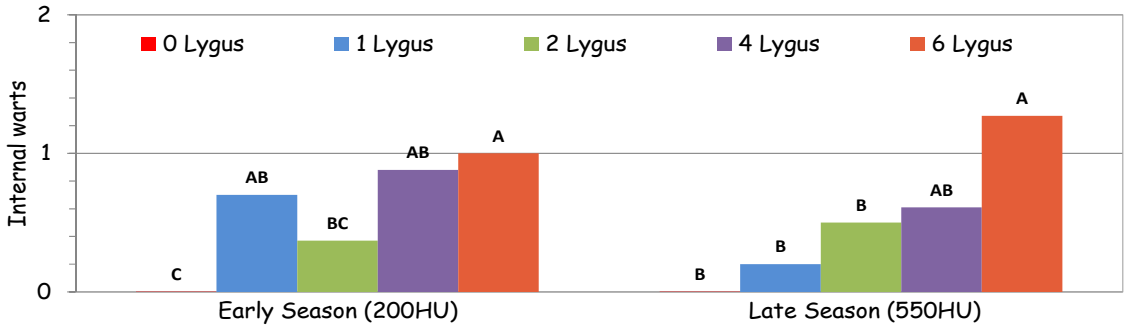

Figure 3. Cotton boll internal injury (internal warts) at two phenological stages of cotton following a 7-day exposure of various densities of *Lygus* adults in multi-plant cages, Lubbock, TX, 2015.

Overall, lint decreased for each successive phenological stages of cotton due to an artifact of experimental logistics (Fig. 4). Each cage contained about 12 plants and plants were thinned to 6 per cages at the time of insect release. As a result, the early season test had significantly more time to compensate for thinned plant densities compared to when we thinned the densities in successive phenological stages. Within each phenological stage, higher *Lygus* densities significantly reduced the lint yield compared to that in control cages. Early season crop compensated for boll injury and the yield in 0, 1, and 2 *Lygus*-augmented cages were similar. During mid-season, *Lygus* infestations reduced yield significantly for all densities, indicating the greater vulnerability of the mid-season crop to *Lygus* injury in the Texas High Plains. In late season, low density of *Lygus* overcompensated the yield as *Lygus* likely fed on young, non-harvestable fruits which provided an opportunity for harvestable bolls to mature (Fig. 4). The seed yield followed the same pattern as observed for lint yield (Fig. 5).

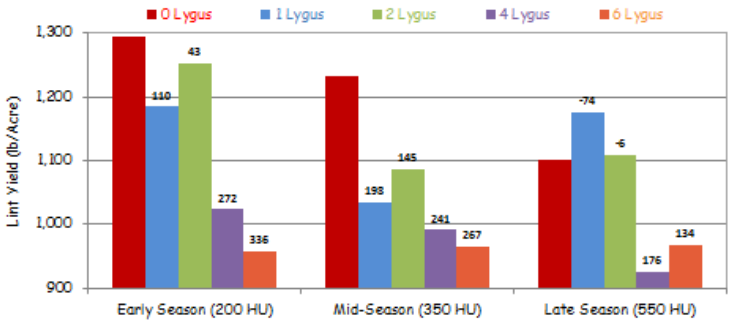

Figure. 4. Cotton lint yield following a 7-day exposure of various densities of *Lygus* adults in multi-plant cages at three cotton phenological stages, Lubbock, TX, 2015.

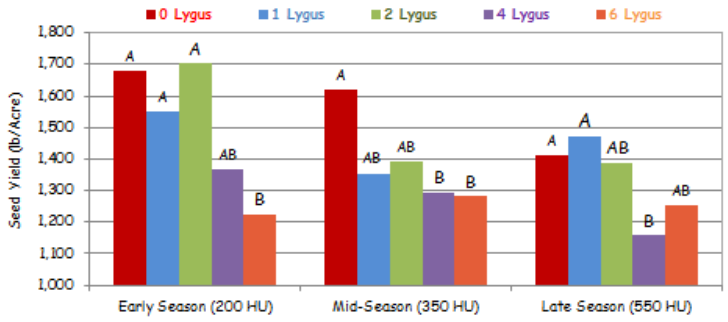

Figure. 5. Cotton seed yield following a 7-day exposure of various densities of *Lygus* adults in multi-plant cages at three cotton phenological stages, Lubbock, TX, 2015.

References

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