PLANT WATER STRESS AND INSECT SEASONALITY EFFECTS ON COTTON FLEAHOPPER DAMAGE

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Abstract

We conducted a second year field experiment in 2012 at Corpus Christi and Lubbock, TX to test whether plant water stress, insect seasonality, and plant sensitivity are interacting factors that result in damage differences attributable to cotton fleahopper feeding which are currently difficult to predict. Fleahopper populations were less sensitive to plant water stress and more sensitive to plant development stage, which may partly explain field to field differences experienced by growers. Detection of fleahoppers in early planted cotton may serve as early warning of cotton fleahoppers in later-planted cotton. Plant/boll vigor in good soil moisture conditions likely benefits cotton in tolerating cotton fleahopper, but it is not advisable to consider this effect in spray decisions given other predominant factors (plant development stage and the previously well-known square sensitivity to damage).

Introduction

Cotton fleahopper, *Pseudatomoscelis seriatus* (Reuter) (Hemiptera: Miridae), can cause excessive loss of cotton squares, resulting in reduced yield and harvest delays (Fig. 1). Cotton fleahopper is a key insect pest of cotton in Texas and Oklahoma, and an occasional pest in New Mexico, Arkansas, Louisiana, and other mid-South states. Within Texas, regional average cotton fleahopper-induced yield loss estimates vary, reaching up to 6% in Texas. Damage to individual fields varies from none to extremely high square loss when heavy populations develop and are left uncontrolled.

How is this variability in cotton fleahopper damage explained? This variability is partly associated with cultivar differences and other host plant factors, with timing and magnitude of cotton fleahopper movement from non-cultivated weed hosts to cotton and the stage of cotton development when migration occurs, and with physical stressors in particular soil moisture.

Understanding how these factors contribute to cotton fleahopper fluctuations may allow better estimation of cotton risk from cotton fleahopper damage. Our ultimate goal is to discern when in-season management (i.e., insecticides, irrigation) is most useful to reduce risk to cotton fleahopper damage than has been previously achieved.

Fig. 1. From left to right, cotton fleahopper adult, nymph, square damage, and a healthy square. Photos provided by authors and Texas AgriLife Research Lubbock and Corpus Christi.

Experimental Question and Approach

We propose that plant water stress, insect seasonality, and plant sensitivity are interacting factors that result in damage differences attributable to cotton fleahopper feeding which are currently difficult to predict.

Field testing in 2011 and 2012 at Corpus Christi and Lubbock, TX; drought conditions provided opportunity to assess insect activity in a high contrast of dryland and irrigated conditions (irrigation targeted as % ET replacement).

We report here cotton fleahopper and harvest results from Corpus Christi in 2012 (revealing fleahopper/water stress relationship), and plant measurement results in Lubbock in 2011 (similar in 2012, revealing plant vigor increases under irrigation).

Corpus Christi

This location had a split-split plot design with 5 replications. The three water regimes of the main plot were dryland, medium irrigation (scheduled at 75% ET replacement), and high irrigation (90%). Water regimes were applied by surface irrigation through drip tubes. The first split plot was the four combinations of 2 planting dates (April 12 and 30 of 2012) and 2 cultivars (Phytogen 367 WRF and Stoneville 5458 B2RF). The plot size was 150 ft by four rows (38 in.), with data taken from the inner two rows. The last split represented insecticide treatment on one third of the plot (orthene sprayed weekly four times beginning at early squaring) where in-season insect data were collected. The remaining plot was left unsprayed, equally divided into use for in-season data collection and undisturbed for harvest. Fleahopper counts (adults and nymphs) were made weekly over a period of 5 weeks after the population exceeded 0.1 fleahopper per plant using the beat bucket technique (20 plants samples per plot) (Fig. 2). Plant measurements included: yield, COTMAN (squareman and bollman), and complete plant mapping using PMAP.

Lubbock

Extremely dry conditions limited the experiment at Lubbock. The plot design was randomized complete block with 3 replications. Water treatment regimes were dryland, low irrigation (30%), medium irrigation (60%), and high irrigation (90%) applied via subsurface drip tubes. The cultivar planted in the test was Deltapline 1032 B2RF and the plot size was 4 rows (38 in.) by 100 ft.. Fleahopper counts were not taken as populations did not develop. Plant measurements were total fruit set, percent fruit retention, and boll size by weight taken at 250 DD 60's.

Fig. 2. Beat bucket sampling for cotton fleahopper; visual observations were done previously and correlated well with beat bucket sampling at Corpus Christi, Texas. KISS sampling was done in Lubbock which confirmed very low populations of fleahoppers.

Results

Corpus Christi:

Insect Measurements

Fleahoppers were detected late with good numbers first occurring June 1, corresponding to mid-bloom for the early planting (42 DAP) and early bloom for the late planting (31 DAP). The early planting had much higher populations when fleahopper first appeared in the field, and sprays suppressed the population in the early planting (Fig. 3). As in the previous year, water regime did not affect initial fleahopper densities (Fig. 3). Two weeks later (June 14), cotton fleahopper populations increased as the later planting matured, and the sprays did not suppress this expanding population (Fig. 4).

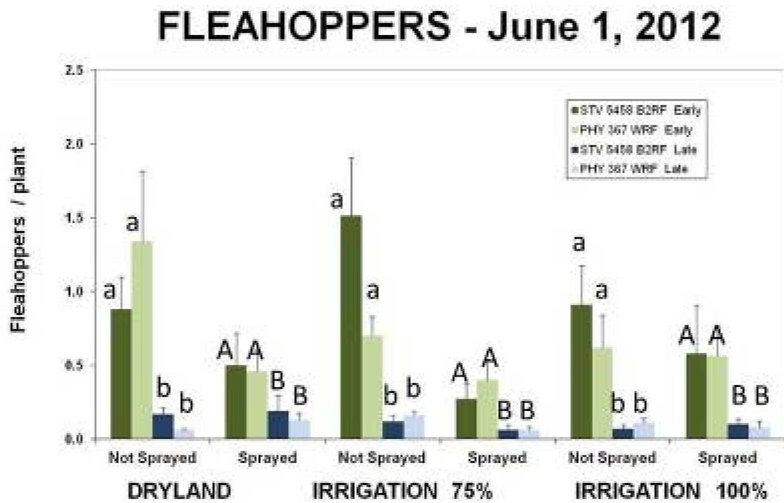

Fig. 3. Cotton fleahoppers per plant on June 1, 2012 of Stoneville 5458 B2RF and Phytogen 367 WRF sprayed and not sprayed planted early (April 12, 2012) and late (April 30, 2012) across 3 water regimes (dryland, 75% ET irrigation, and 100% ET irrigation) at Corpus Christi, Texas.

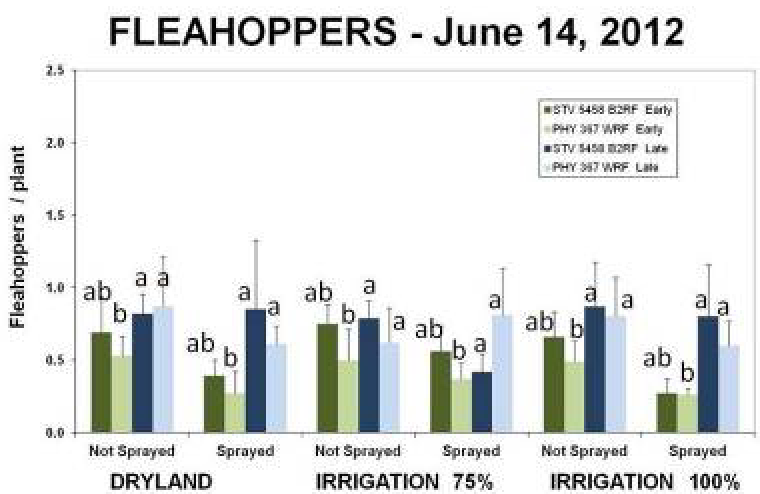

Fig. 4. Cotton fleahoppers per plant on June 1, 2012 of Stoneville 5458 B2RF and Phytogen 367 WRF sprayed and not sprayed planted early (April 12, 2012) and late (April 30, 2012) across 3 water regimes (dryland, 75% ET irrigation, and 100% ET irrigation) at Corpus Christi, Texas.

Plant Measurements

Irrigation significantly increased yield, and the early planting had higher yields under irrigation. Yield reduction attributable to fleahopper was not detected; even though the early planting had higher fleahopper populations (including ones above the economic threshold of 15 fleahoppers per 100 plants in our area) (Fig. 5).

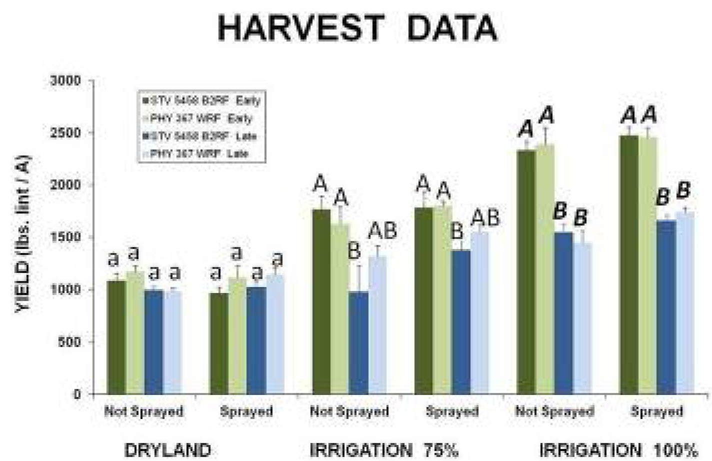

Fig. 5. Lint yield (lbs/A) of Stoneville 5458 B2RF and Phytogen 367 WRF sprayed and not sprayed planted early (April 12, 2012) and late (April 30, 2012) across 3 water regimes (dryland, 75% ET irrigation, and 100% ET irrigation) at Corpus Christi, Texas.

<u>Lubbock:</u>

<u>Plant Measurements</u>

The total number of fruit set per plant increased with increasing irrigation, but fruit retention suffered only when irrigation was reduced (low irrigation and dryland) (data taken from a complete plant mapping on August 3, 2011) (Fig. 6). The irrigation level significantly influenced cotton fruit physiology, with larger and heavier bolls with harder carpell walls produced at high irrigation regimes compared to those at the low irrigation and dryland (Figs. 7 and 8.).

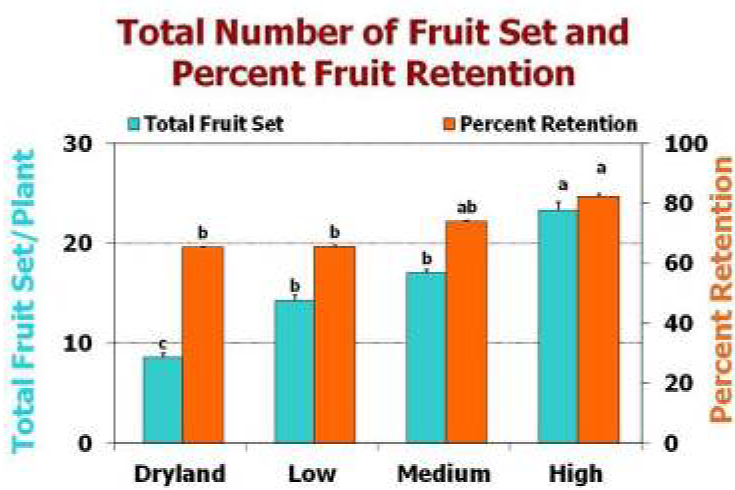

Fig. 6. Total number of fruit set per plant and percent fruit retention but fruit retention under 4 water regimes (dryland, low, medium, and high) on August 3, 2011 at Lubbock, Texas.

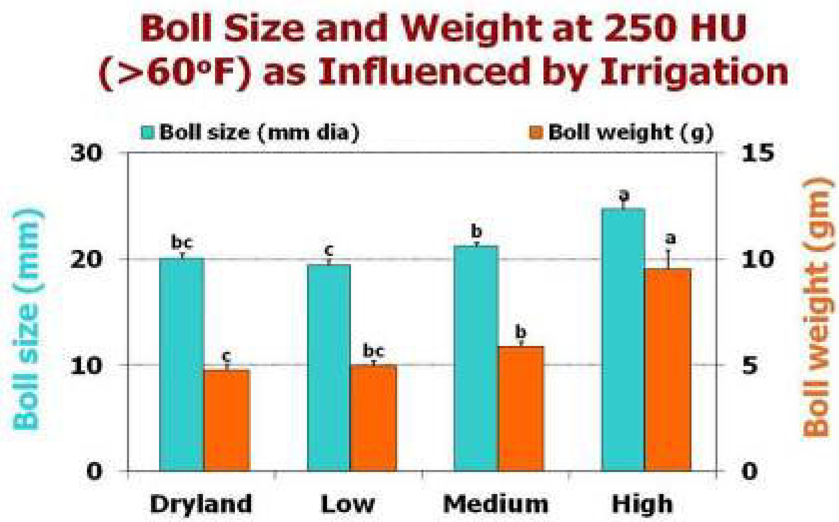

Fig. 7. Boll size(mm) and boll weight(gm) at 250 heat units(>60 ºF) post bloom under 4 water regimes (dryland, low, medium, and high) at Lubbock, Texas.

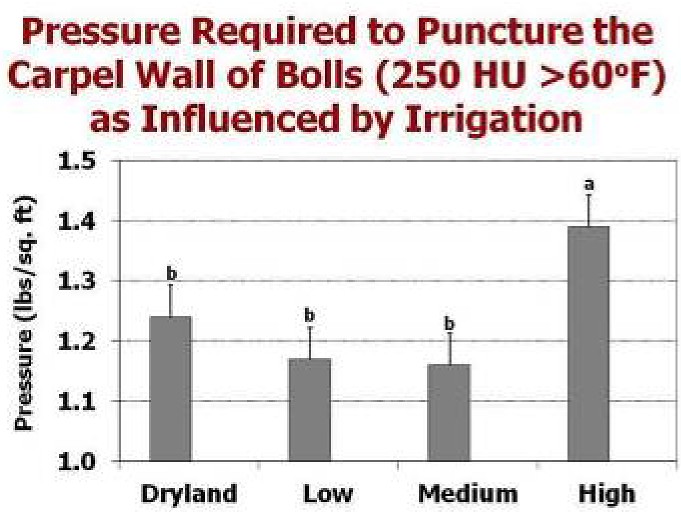

Fig. 8. Pressure required to puncture the carpel wall of bolls(250 heat units post bloom >60ºF) under 4 water regimes(dryland, low, medium, and high irrigation).

Acknowledgements

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