Cotton Fleahopper and Its Damage to Cotton as Affected by Plant Water Stress and Insect Seasonality

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Introduction

Cotton fleahopper, *Pseudatomoscelis seriatus* (Reuter) (Hemiptera: Miridae), can cause excessive loss of cotton squares, resulting in reduced yield and harvest delays. 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 (Williams 2000). Damage to individual fields vary 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 (Holtzer and Sterling 1980, Knutson *et al.* 2009, Barman *et al.* 2011), with timing and magnitude of cotton fleahopper movement from non cultivated weed hosts to cotton and the stage of cotton development when migration occurs (Parajulee *et al.* 2006), and with physical stressors in particular soil moisture (Stewart and Sterling 1989).

Understanding of these factors contributions to cotton fleahopper dynamics will allow better estimation of cotton risk from cotton fleahopper damage. Some of these factors are manageable. Our ultimate goal is to discern when in-sesaon management (i.e., insecticides, irrigation) is most useful to reduce risk to cotton fleahopper damage than has been previously achieved.




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 initiated in 2011 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). Drought conditions resulted in delays of cotton fleahopper occurrence in Corpus Christi, and in very low cotton fleahopper density in Lubbock season-long. Therefore, we have reported cotton fleahopper and harvest results from Corpus Christi and plant measurement results from Lubbock.

<u>Corpus Christi</u>

Split-plot with five replications
- Main plot: water regimes
  - Dryland
  - Medium Irrigation (75%)
  - High Irrigation (90%)
- Split: combination of 3 cultivars and 2 planting dates
  - Phytogen 367 WRF (April 1/April 15)
  - Deltapine 1032 B2RF (April 1/April 15)
  - Stoneville 5458 B2RF (April 1/April 15)

Plot size: 100 ft by four rows, data from inner two rows, half of plot for in-season data collection and half left undisturbed for harvest

Insect Measurements:
- 5 cotton fleahopper weekly sampling dates once population exceeded 0.1 fleahopper per plant using a beat bucket; 10 plants sampled per plot

Plant measurements:
- Yield (lbs lint/acre) (reported here, other measurements were similar)
- COTMAN in-season and complete plant mapping at cutout (analyses in progress)

<u>Lubbock</u>

RCB with three replications

Treatment: water regimes
- Dryland
- Low Irrigation (30%)
- Medium Irrigation (60%)
- High Irrigation (90%)

Cultivar
- Deltapine 1032 B2RF

Plot size: same as Corpus

Insect Measurements:
- Cotton fleahopper populations did not develop in Lubbock vicinity in 2011

Plant measurements:
- Total fruit set and % fruit retention
- Boll size/wt at 250 DD (60F base)

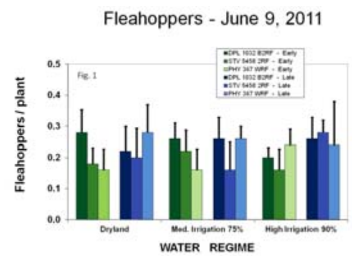
Beat bucket sampling for cotton fleahopper; visual observations were also done and correlated well with beat bucket sampling. Corpus Christi.

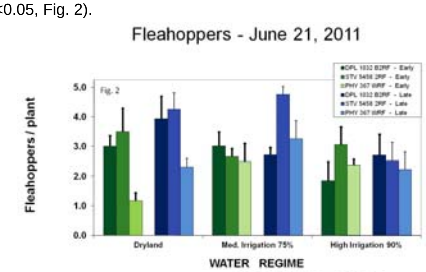
Summary

We live in a climate that produces highly variable weather year to year and within-season in Texas. Across many plant/insect systems, such variability affect plant physiology, insect population growth, and their interactions. The first year of this experiment allowed us to simulate a broad range of water availability. Our data supported the hypotheses that water affects plant response positively (especially revealing in Lubbock), and may position the plant to withstand cotton fleahopper feeding or affect the insect's population growth across the season (especially revealing in Corpus). Additional study years and experiments will help us discern the interactions.

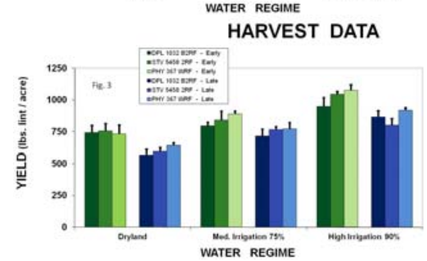
Results

Corpus Christi: *Insect Measurements.* Cotton fleahoppers were detected late with good numbers first occurring June 9 (about 1 month late), corresponding to peak bloom for the early planting (about 8 NAWF) and early bloom for the late planting (about 7 NAWF). There was no major pattern in the fleahopper populations related to the treatments (P>0.05 for treatments and interactions Fig 1). In 2 weeks, fleahopper populations increased on average 10-fold. They tended to be least abundant in the early planting (8NAWF) and in the high irrigation regime (P<0.05, Fig. 2).

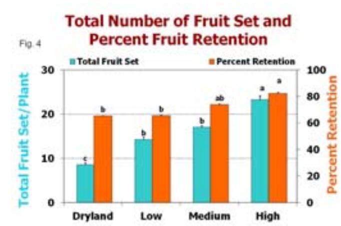




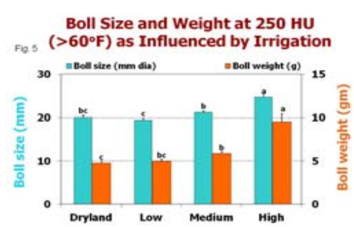
Plant Measurements. Lint yield was greatest in the high irrigation regime and in the early planting for all cultivars (P<0.05 for main effects, Fig. 3), where cotton fleahoppers also were less abundant (Fig. 2). Through season COTMAN data and at cutout complete plant mapping data are being processed. These data will be used to compare yield, fleahopper abundance, and cotton fruit set and retention.

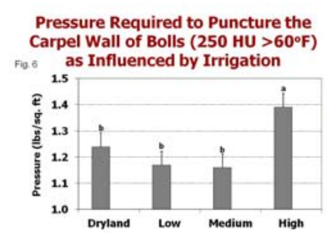


Lubbock: *Plant Measurements.* Total number of fruit set per plant increased with increasing irrigation, but fruit retention suffered only when irrigation was reduced (low irrigation and dryland) (Fig. 4, data taken from a complete plant mapping on August 3, 2011).



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. 5 and 6).





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