Cotton Fleahopper Damage on Water-Stressed Cotton

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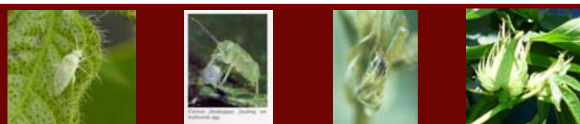
Introduction

Cotton fleahopper, *Pseudatomoscelis seriatus* (Reuter) (Hemiptera: Miridae), has been documented to cause excessive loss of cotton squares in Texas and Oklahoma, resulting in reduced yield and harvest delays. Cotton fleahopper is also 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% (Williams 2000). A challenge to management is that square loss and subsequent yield loss to individual fields varies considerably as populations build.

This variability has been partly associated with cultivar differences and other host plant factors (Holtzer and Sterling 1980, Knutson *et al.* 2009, Barman *et al.* 2011), with the stage of cotton development when migration occurs (Parajulee *et al.* 2006), and with physical stressors in particular plant water stress (Stewart and Sterling 1989). Even though foliar insecticide application may control the population, benefits to control may depend on these factors.

Understanding the degree to which these factors contribute to cotton fleahopper fluctuations and subsequent plant damage may allow better estimation of cotton risk from cotton fleahopper leading to better use of in-sesaon management (i.e., insecticides).



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 Approach

We propose that plant water stress and plant vigor, and plant development at the time of infestation are main factors that affect cotton fleahopper population fluctuation and plant response/yield loss. These factors were considered in two studies, one in South Texas, and the second in the Texas High Plains.

Field testing in 2013 during drought conditions provided opportunity to assess insect activity in a high contrast of dryland (with supplemental irrigation due to severe drought) and irrigated (irrigation targeting 90% crop ET replacement) water regimes. The South Texas location focused on following a natural cotton fleahopper population and subsequent yield in a plot with two water regimes, two planting dates, two cultivars, and controlled with insecticide or not. The Texas High Plains location focused on plant response using a simulated acute population of cotton fleahopper under two water regimes.

South Texas: Corpus Christi

Design & Agronomics:
Split-split-split plot with five replications
Main plot: Two water regimes
- Low irrigation in drought
  - Earlier planting: 6.1 in. of water
  - Later planting: 7.9 in. of water
- High irrigation
  - Earlier planting: 10.4 in. of water
  - Later planting: 13.8 in. of water

1st split: Two planting dates
- Earlier (May 6) & Later (May 31) (both agronomically late)

2nd split: Two cultivars
- Phytogen 367 WRF
- Stoneville 5458 B2RF

3rd split: Insecticide use
- Centric 40 WG (thiamethoxam): 1.25 oz/A
  - June 11 & 18 and July 3 & 15
- No insecticide

Irrigation by above ground drip

Insect Measurements:
9 weekly samplings (20 plants per plot) beginning when fleahoppers exceeded 10 bugs per 100 plants using a beat bucket

Plant measurements:
Yield (lbs lint/acre)
Boll load & plant ht for unsprayed plots

Texas High Plains: Lamesa

Design & Agronomics:
2 by 2 factorial with three replications
1st factor: Water regimes
- Low irrigation in drought (4.5 in.)
- High Irrigation (9 in.)

2nd factor: Infestation rate
- Control (no infestation)
- 5 nymphs/plant at 3rd week of squaring

Irrigation by center pivot
Plot size: 45 ft by 4 rows
Infestations applied to uniform-sized plants

Insect Measurements:
Cotton fleahopper populations were low, the site was used for artificial infestation

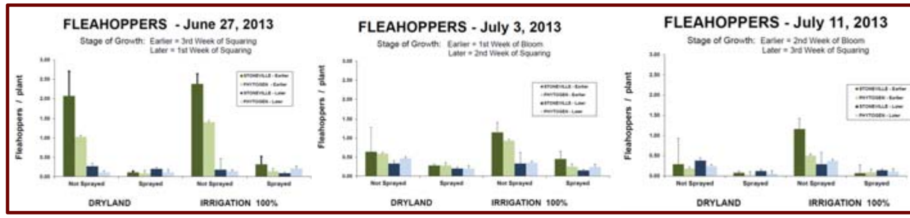
Plant measurements:
Yield (lbs/acre)
Boll load

Summary Interpretation

We live in a climate that produces highly variable weather, as seen in drought conditions in Texas the last two years. Plant water stress affects natural cotton fleahopper populations (South Texas study: increasing more in irrigated plots) and water stressed plants are more sensitive to equal cotton fleahopper pressure (High Plains study: lint loss and possibly boll load decreasing more in low irrigation plots). As seen last year, plant development stage at the time of initial cotton fleahopper infestation is crucial, with early squaring cotton having higher densities than cotton at early bloom in the infestation (South Texas study). For field application, detection of fleahoppers in early planted cotton may serve as early warning of cotton fleahoppers in later-planted cotton. As the infestation progresses, fleahoppers may persist better in cotton with low water stress. But the greatest potential for yield decline from cotton fleahopper was when cotton is water stressed and infestations occur during pre-bloom squaring.

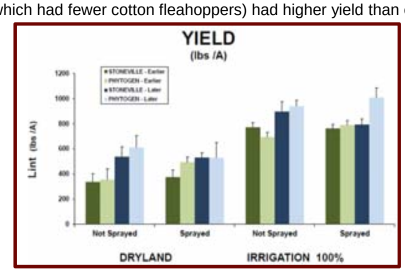
Results

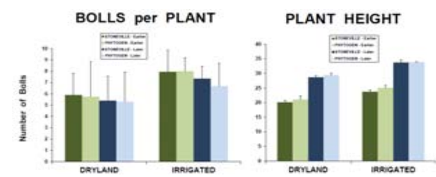
South Texas: *Insect Measurements.* Fleahoppers exceeded an ET of 15% of plants infested. More cotton fleahoppers were seen on earlier planted cotton ($P < 0.0001$), especially early in the infestation (June 27 when the earlier planted cotton was at 3rd week of squaring and the later planted cotton was at the 1st week of squaring). Cotton fleahopper density did not differ between dryland and irrigated plots at the beginning of the infestation (June 27, $P = 0.24$), but as the infestation progressed more fleahoppers were detected in irrigated plots on July 3 ($P = 0.04$) and on irrigated plots of the earlier planted cotton on July 11 ($P = 0.009$). Cultivar differences were also detected, supporting historical claims of cultivar effects ($P = 0.005$), The insecticide Centric controlled fleahopper well across most conditions ($P < 0.0001$), even the very high populations found on June 27 in the earlier planting during the 3rd week of squaring.



Plant Measurements. There was a good yield response with the best yields seen under irrigation for both cultivars, planting dates, and with or without insecticide protection ($P = 0.0008$). The benefits of good soil moisture were seen on unsprayed plots, which had had higher bolls loads on taller plants (right two graphs showing irrigation benefit on plots not sprayed with insecticide).

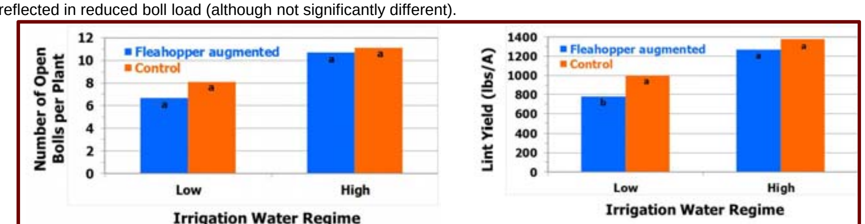
Yield also increased when plots were sprayed, but to a much smaller degree ($P = 0.05$), and the later planted cotton (which had fewer cotton fleahoppers) had higher yield than earlier planted cotton ($P = 0.006$).





Plant mapping done end of season on plots not sprayed

Texas High Plains: *Plant Measurements.* Natural populations of cotton fleahopper were low at this site which allowed field comparison of plant response to an acute constant infestation of 5 nymphs during the 3rd week of squaring, which was shown to host cotton fleahopper well at the South Texas site. When plants were not water stressed (high irrigation), there was no effect of cotton fleahopper pressure looking at boll load (left) and lint yield (right). But under water stress (low irrigation during a drought year), there was yield loss due to cotton fleahopper pressure ($P < 0.05$), which was also reflected in reduced boll load (although not significantly different).



Acknowledgements

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