Development of Thresholds for Management of Sugarcane Aphid on Sorghum

J. Gordy¹, M. Brewer², R. Bowling², M.O. Way³, D. Buntin⁴, D. Kerns⁵, N. Seiter⁶
¹Texas A&M University Department of Entomology, Rosenberg, Texas; ²Texas A&M AgriLife Research and Extension Center, Corpus Christi, Texas; ³Texas A&M AgriLife Research and Extension Center, Beaumont, Texas; ⁴University of Georgia Department of Entomology, Griffin, Georgia; ⁵Texas A&M University Department of Entomology and AgriLife Extension, College Station, Texas; ⁶University of Illinois Department of Crop Sciences, Urbana, Illinois

ABSTRACT

The sugarcane aphid (Maliaphis sacchari) is a newly established pest of sorghum in North America. Because this pest can cause significant economic injury to sorghum at various stages of growth, we evaluated yield–aphid population relationships, and calculated economic thresholds under various management scenarios to mitigate economic loss. Susceptible grain sorghum hybrids were evaluated at increasing levels of aphid pressure, near 0 to 500 aphids/leaf, as manipulated with an insecticide. The trials were performed at university research centers at Corpus Christi, Texas and Winnie, Louisiana in 2014 and 2015, and at Monticello, Arkansas; Griffin, Georgia; and in a commercial grain sorghum field near Rosenberg, Texas in 2015. Treatments were replicated three (Rosenberg) or four (all other locations) times and arranged in a randomized complete block design. Leaves were examined weekly and insecticide was applied when aphid populations reached designated treatment levels. Yield data were collected and a regression analysis was performed to determine yield loss–aphid population relationships and corresponding economic injury levels for several management scenarios, including estimates of yield loss and proportion of leaves with <25, 50 and >100 aphids. Yield loss ranged from 0.3 to 455 pounds/acre per 100 aphids/leaf. Aphid population doubling time was calculated using the formula DT = (log2EIL)/r and ranged from 3.9 to 8.5 days. Based on Pedigo’s method (EIL = C/(V*I*D*K)), an economic threshold of 50-75 aphids per leaf was calculated for sugarcane under various management scenarios. Other sampling methods did not provide consistent results and need additional evaluation before they can be used with confidence.

INTRODUCTION

Grain sorghum, Sorghum bicolor L., is an important crop in the United States. The key insect pests of sorghum include several aphid species, sorghum midge, and headworms (Cronholm et al. 2007). The first report of the sugarcane aphid, Maliaphis sacchari, in the continental United States was on sugarcane in Florida in 1977 (Denmark 1988). While Denmark also reported that sugarcane aphid would feed on Sorghum spp., it was not considered a pest until the recent outbreak on sorghum first detected along the Texas–Texas–Coast in 2013 (Bowling et al. 2016). The increase in the prevalence of the pest and its potential to impact sorghum production prompted an interest in developing economic decision tools to gauge when to apply a foliar insecticide. Small plot field research at Texas A&M AgriLife and LSU AgCenter research facilities in South Texas and North Louisiana (Brewer et al. 2017), led to a preliminary economic threshold of between 50 and 125 aphids/leaf. This project is a continuation of the work done in 2014, and has been expanded to include partners from Texas, Louisiana, Arkansas, and Georgia.

The objectives were 1) to establish an economic threshold using aphid–yield response data obtained across several locations and growing seasons, 2) estimate the population growth potential (doubling-time) and 3) investigate alternative estimating aphid densities for using economic thresholds.

MATERIALS AND METHODS:

PLOT ARRANGEMENT:

2014, 2015, 2016:
-Plot size: ~40 ft by 4 rows, data taken on inner two rows
-Action triggers of 50, 125, 250, 500 aphids/leaf & UTC, manipulated using Transform WC (sulfosulfuron, 1.0 oz/ac) or Sivanto (thiobendazole, 4.0 oz/ac)

2017:
-Plot size: ~40 ft by 4 rows, data taken on inner two rows; 1/1000 acre subplots within large-farm strip trials
-Small split plot “a” aphids (above insectsicides) and unmanaged 1/1000 acre subplots – unmanaged (12 per hybrid), hand harvested

Sorghum Hybrids:
-2014 ATX7525 x RTX430
-2015 DKS53-67, ATX2752 x RTX430, P8399
-2016 DKS 53-67, P84880
-2017 DKS 53-67

SAMPLING MEASURES:

2014, 2015:
-Insect measures weekly to semi-weekly after first detection
-Estimate aphids on two leaves, one lower, one upper leaf on 10 plants (20 leaves total)

2016, 2017:
-Estimate number of aphids on one upper and one lower leaf of 10 plants (20 leaves total)
-Estimating aphids/leaf procedure: Estimate aphids on each leaf and record separately.

RESULTS

Yield Response to Maximum Number of Aphids per Leaf by Location by Year

<table>
<thead>
<tr>
<th>Location/Year</th>
<th>2014</th>
<th>2015</th>
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<tbody>
<tr>
<td>Corpus Christi (TX)</td>
<td>2014</td>
<td>2015</td>
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<tr>
<td>Rosenberg, Texas (DSC)</td>
<td>2014</td>
<td>2015</td>
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<tr>
<td>Winnsboro, Louisiana (LA)</td>
<td>2014</td>
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<td>Monticello, Arkansas (AR)</td>
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Table 2: Economic Threshold Regression for selected location years

<table>
<thead>
<tr>
<th>Location</th>
<th>Year</th>
<th>Economic Threshold (Obj. 1)</th>
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<tbody>
<tr>
<td>LGC2014</td>
<td>2014</td>
<td>$15/acre</td>
</tr>
<tr>
<td>LGC2015</td>
<td>2015</td>
<td>$20/acre</td>
</tr>
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Table 3: Summary of regression coefficients for the effect of Maximum Aphid Count on Yield by location. Yield loss of maximum yield (using y-intercept) per 100 aphids/leaf ranges from 5.8% to 14.3% with an average of 9.1%}

REFERENCES


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Additional information is available at: http://cagc.tamu.edu/sorghum-insect-pests