Sugarcane Aphid Economic Threshold and Sampling Update

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Department of Entomology

http://ccag.tamu.edu/entomology/
http://ccag.tamu.edu/sorghum-insect-pests/
Contacts and thanks

Thresholds, sampling, hybrids, mixed species management
M. Brewer, J. Gordy (Ph.D./Extension), M. Way, Research
R. Bowling, A. Knutson, Extension
Link: B. Rooney, G. Peterson, Research
N. Elliott, ARS, D. Kerns, LSU; N. Seiter, U. Arkansas;
D. Buntin, U. Georgia, T. Royer (OK)

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Texas Grain Sorghum Board
USDA NIFA Southern IPM Center
United Sorghum Checkoff Program
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USDA Step-up Training, Undergrads (TAMU Kingsville, Del Mar College)
TAMU COALS Fellowships, Grads
Monsanto/Syngenta, harvesting, equipment
Outline

I. Background (M. Brewer)
   The Aphid and Plant Damage Distribution, Overwintering, and Impact

II. First steps to management (M. Brewer)
    Identification (insects and plant injury)
    Detection and sampling

III. Management in Grain Sorghum (J. Gordy)
    Thresholds
    In the field: selection and use of thresholds

IV. A Promising future of Integrated management (J. Gordy)
    Natural enemies
    Commercial hybrid reduced susceptibility
    Research plans for 2016
I.  Background: The Aphid, Plant Damage

Grasses where nymphs & adults were observed:
Sorghum, johnson grass,
Sorghum-sudan
Other sorghum forages

No observations on sugarcane (other strain)
Observed on corn, but no/little reproduction

Some sorghums are great hosts
Underside of leaves & stems,
Bottom to top of plant

G. Odvody/M. Brewer, Texas A&M AgriLife Research
Things happen fast, but the plant doesn’t die immediately

Pre-flowering arrival/increase
Less grain/
No heads
Aphids/honeydew
at harvest

Asexual reproduction, required green host primarily *Sorghum* sp.
Plant damage caused by general plant decline, head emergence problems
Honeydew and aphids reduce harvest effectiveness
Coastal Bend growers, IPM officials meet on sugarcane aphid problems

Video Links

Brewer, Way, Villanueva, Kerns, Armstrong

I. Background: Distribution, Overwintering, and Impact

2013 Sugarcane Aphid Occurrence in Sorghum

Aug/Sept

2012: Spots detects in South Texas

Counts with Sugarcane Aphid in Sorghum

Background:
Distribution, Overwintering, and Impact
2015 Sugarcane Aphid, *Melanaphis sacchari*, Occurrence on Sorghum United States and Mexico

September 15, 2015

Lead: Robert Bowling
Texas A&M
AgriLife Extension
Occurrence of Overwintering Sugarcane Aphid in Texas
April 24, 2015
## Grain Sorghum Impact in 2014

<table>
<thead>
<tr>
<th>State</th>
<th>Acre Infested by Sugarcane Aphid</th>
<th>Sorghum Production Losses from SA Infestations</th>
<th>Monetary Loss in production from SA</th>
<th>Sorghum Acres Treated for SA Infestations</th>
<th>Cost for Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>LA</td>
<td>100%</td>
<td>15% (1.8mm bu)</td>
<td>$7.2mm</td>
<td>75%</td>
<td>$1.1 mm</td>
</tr>
<tr>
<td>AL</td>
<td>100%</td>
<td>20% (0.22mm bu)</td>
<td>$0.88mm</td>
<td>75%</td>
<td>$0.20 mm</td>
</tr>
<tr>
<td>OK</td>
<td>10%</td>
<td></td>
<td></td>
<td>10%</td>
<td>$0.39 mm</td>
</tr>
<tr>
<td>GA</td>
<td>90%</td>
<td>15% (0.3mm bu)</td>
<td>$1.2mm</td>
<td>80%</td>
<td>$0.56mm</td>
</tr>
<tr>
<td>AR</td>
<td>90+%</td>
<td>15% (1.9mm bu)</td>
<td>$7.7mm</td>
<td>70%</td>
<td>$0.42mm</td>
</tr>
<tr>
<td>MS</td>
<td>100%</td>
<td>15% (0.87mm bu)</td>
<td>$3.5mm</td>
<td>70%</td>
<td>$1.1 mm</td>
</tr>
<tr>
<td>TX</td>
<td>60%</td>
<td>5% (6.4mm bu)</td>
<td>$34.8mm</td>
<td>35%</td>
<td>$10.5mm</td>
</tr>
<tr>
<td>South TX</td>
<td>100%</td>
<td>15% (8.7mm bu) w/o management: Up to 50%</td>
<td>$25.6mm</td>
<td>60%</td>
<td>$8.1mm</td>
</tr>
<tr>
<td>South TX 2015</td>
<td>50-75%</td>
<td></td>
<td>$30-120mm</td>
<td>in yield savings</td>
<td>30-40%</td>
</tr>
</tbody>
</table>
Management: feasible & challenging

+ Limited in landscape: *Sorghum* spp.
+ Damage from general decline, no acute toxicity
+ Not a vector, or only a potyvirus
+ Grain value
+-/- Forage value
- Asexual, rapid reproduction
- Monitoring challenge:
  Wind-aided movement
  Aphids are small / leaves are green
II. First steps to management:
Proper ID (insect & sorghum injury)

Which is sugarcane aphid? Which is tolerable injury and which is economic damage?

S. Armstrong, USDA ARS, Stillwater, OK

J. Gordy, Texas A&M AgriLife Extension
Which is tolerable injury and which is economic damage?

<table>
<thead>
<tr>
<th>Aphids/Leaf</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>250</td>
<td><img src="https://example.com/imageA.png" alt="Image A" /></td>
</tr>
<tr>
<td>50</td>
<td><img src="https://example.com/imageB.png" alt="Image B" /></td>
</tr>
<tr>
<td>500</td>
<td><img src="https://example.com/imageC.png" alt="Image C" /></td>
</tr>
</tbody>
</table>

### Quick Aphid Checker

Estimate the number of sugarcane aphids (BCA) per leaf to help time foliar insecticides for BCA control on sugarcane. Each photo represents an estimate from the table. For example, photo A shows about 12 aphids.

<table>
<thead>
<tr>
<th>Estimate the Number of Aphids per Leaf</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photo</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>A</td>
</tr>
<tr>
<td>B</td>
</tr>
<tr>
<td>C</td>
</tr>
<tr>
<td>D</td>
</tr>
<tr>
<td>E</td>
</tr>
<tr>
<td>F</td>
</tr>
</tbody>
</table>

Field Average = Total of All Estimates / Total # of Leaves Examined

Learn more about sugarcane aphids at [http://cag.tamu.edu/entomology/](http://cag.tamu.edu/entomology/)

Photos courtesy of Travis Johnson, Mike Brewer, Allen Kautzman, and Pat Portier.

Funding provided by the Texas Cotton Singhane Producers Board and the USDA NIFA Southern IPM Center and Crop Protection.

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II. First steps to management:

Identification

Hoverflies (Syrphidae)

S. Armstrong, USDA ARS, Stillwater, OK

Allograpta obliqua

Pseudodorus clavatus (syn. Dioprosopa clavata)

Unknown species

E. Maxson, Texas A&M AgriLife Research

© Erin Maxson 2015

http://cagg.tamu.edu/entomology/
Natural enemies,
Courtesy of E. Maxson, J. Woolley, M. Brewer, AgriLife Research

Lady Beetles (Coccinellidae)

E. Maxson, Texas A&M AgriLife Research

Coleomegilla maculata
Harmonia axyridis
Olla v-nigrum (light form)

Coccinella septempunctata
Cycloneda sanguinea
Hippodamia convergens
Green Lacewings (Chrysopidae)

Cereaochrysa sp.

Brown Lacewings (Hemerobiidae)

Hemerobius sp.
Parasitoids

*Aphelinus* sp. *varipes* group (*Aphelinidae*)
adults (left) and live and mummified aphids (right)

*Syrphophagus* sp. (*Encyrtidae*)
Hyperparasitoid of *Aphelinus* sp.

*Lysiphlebus testaceipes*
adult and mummies
(*Braconidae*)

Image courtesy of T. Ahrens

Image courtesy of X. Shirley

Image courtesy of Univ. Calif. IPM Program

Image courtesy of James Woolley
II. First steps to management:

Sampling strategy

Courtesty of N. Seiter, U. Ark., N. Elliott, ARS; T. Royer, OSU

Research for Improved on-crop sampling

Clumped or uniform: Sample plants individually or consecutively?

Clumped early

Edge effect: Sample plants along edge and/or in field interior?

Soft edge early
Current best strategy

➢ Proper ID
➢ Divide sampling effort

- Focus weekly **Fast Detection** for first detection in many fields
  - Check 50 foot of row dividing effort along edge and interior of field
  - Fold leaves over and check for honeydew during a slow walk
  - If no aphids detected, continue weekly **Fast Detection**
  - If aphids detected, switch to twice weekly **Quick Aphid Checker**

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Timing effective treatment to control sugarcane aphids (SCA) in sorghum depends on the size of the SCA population. To estimate the number of SCA in a field, follow these steps for scouting the field and use the **Sampling Protocol** (below) and the **Quick Aphid Checker** (on back) to make treatment decisions.

### First Detection: Is the Field at Risk?

- Once a week, examine plants along 50’ of row dividing effort between the field edge and 25’ into the field.
- If honeydew is present, look for SCA on the underside of a leaf above the honeydew.
- Inspect the underside of leaves from the upper and lower canopy from 15–20 plants per location.
- Sample each side of the field as well as sites near Johnsongrass and tall mutant plants.
- Check at least 4 locations per field for a total of 60–80 plants.

If no SCA are present, or only a few wingless/winged aphids are on upper leaves, continue once-a-week scouting.

If SCA are found on lower or mid-canopy leaves, begin twice-a-week scouting. Use the Sampling Protocol and the Quick Aphid Checker to determine if aphid densities exceed the economic threshold.
Proper ID

Divide sampling effort
- For infested fields, twice weekly **Quick Aphid Checker** for aphid estimates
  Twice a week is critical especially during warm dry conditions
  Using picture key, estimate aphid numbers on at least 40 leaves
  example: 2 leaves per plant, 5 random plants, four locations = 40 leaves
  Calculate the average aphids/leaf and compare to selected threshold
  Once sprayed, check for control and aphid re-appearance (3, 7 days)
  Monitoring aphids and other pests until dry down is critical

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**Quick Aphid Checker**
Estimate the number of sugarcane aphids (SCA) per leaf to help time foliar insecticides for SCA control on sorghum.
Each photo represents an estimate from the table. For example, photo A shows about 12 aphids.

<table>
<thead>
<tr>
<th>Photo</th>
<th>Range</th>
<th>Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1–25</td>
<td>12</td>
</tr>
<tr>
<td>B</td>
<td>26–50</td>
<td>33</td>
</tr>
<tr>
<td>C</td>
<td>51–100</td>
<td>76</td>
</tr>
<tr>
<td>D</td>
<td>101–500</td>
<td>300</td>
</tr>
<tr>
<td>E</td>
<td>501–1000</td>
<td>750</td>
</tr>
<tr>
<td>F</td>
<td>&gt;1000</td>
<td>1500</td>
</tr>
</tbody>
</table>

Field Average = Total of All Estimates / Total # of Leaves Examined

Learn more about sugarcane aphids at [http://ccag.tamu.edu/sorghum-insect-pests/](http://ccag.tamu.edu/sorghum-insect-pests/)

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Photos courtesy of Travis Adams, Mike Brewer, Allen Lancaster, and Pat Porter.
Funding provided by the Texas Cotton Sorghum Producers Board and the USDA NIFA Sorghum IPM Center and Crop Protection.

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III. Management in Grain Sorghum
Threshold Experiment for susceptible grain sorghum hybrids

2014
LGC: Corpus Christi, TX
NLA: Winnsboro, LA

2015
LGC: Lower Gulf Coast (Brewer) Planted: May 1 (2nd planting)
UGC: Upper Gulf Coast (Gordy) Planted: July 16 (3rd planting)
OK: Oklahoma (Royer) Planted June 4 (2nd planting)
NLA: North LA (Kerns) Planted: May 29 (2nd planting)
AR: Arkansas (Seiter) Planted June 9 (2nd planting)
GA: Georgia (Buntin) Planted June 15 (1st planting)

Early Planting
Escaped damage
LGC, UGC, OK, NLA, RA

Late Planting
Aphids arrived pre-boot

A. Reyes, C. Stanton, AgriLife Research
Sorghum ‘S’ Hybrids: Threshold Experiment

Plot size: 40 ft by 4 rows, data taken on inner two rows
Action triggers for foliar insecticide
   (0 GA only), 50, (100 to 125), 250 & 500 aphids/leaf & UTC
Transform (sulfoxaflor) 1.0 oz per acre, 10-15 GPA

First aphids arrived at 5-6 leaf, pre-boot

Sorghum Hybrids:
   2014
   LGC: RTX430, 1 spray max
   NLA: RTX430, 2 sprays max

   2015
   LGC: Dekalb DKS 53-67, 1 spray max
   UGC: Dekalb DKS 53-67, 4 sprays max
   OK:   DKS53-67, 1 spray max
   NLA: TX430, irrigated, 2 sprays max
   AR:    P83P99, irrigated, 3 sprays max
   GA:    SS800A, 3 sprays max

Measurements: weekly
Aphid density (aphid/leaf)
   20 leaves per plot,
   10 top-half, 10 bottom-half
   used quick aphid checker
   (5-10 min per plot)

Yield
2014, 2015 Results in Pictures, Susceptible (TX430, DKS 53-67)

50/100 (S)
Few aphids 7-14 DAT, no injury, no yield loss, natural enemies reduced

LGC: 1 spray
UGC: 4 sprays
NLA: 2 sprays
GA/AR: 3 sprays

250 (S)
Few aphids 7-14 DAT, sooty mold detected, no yield loss, abundant natural enemies

LGC: 1 spray
UGC: 3 sprays
NLA: 1 spray
GA/AR: 1 or 2 sprays

UTC & 500 (S)
High aphids 7-14 DAT, damage visible, yield loss, natural enemy zoo

LGC/UGC: 0 spray
NLA: 0 spray
GA/AR: 0 or 1 spray
## 2015 Yield (Susceptible hybrid)—Max Aphid Load Regression

### Maximum Aphids Per Leaf

<table>
<thead>
<tr>
<th>Location</th>
<th>Slope (lb./acre per aphid/leaf)</th>
<th>Y-intercept (Max. Est. Yield)</th>
<th>( R^2 )</th>
<th>Yield loss per 100 aphids/leaf</th>
<th>Percent Yield loss per 100 aphids/leaf</th>
</tr>
</thead>
<tbody>
<tr>
<td>OK</td>
<td>-1.2087</td>
<td>1,234</td>
<td>0.3949</td>
<td>120 lb./acre</td>
<td>9.8%</td>
</tr>
<tr>
<td>UGC</td>
<td>-1.5427</td>
<td>1,272</td>
<td>0.6827</td>
<td>154 lb./acre</td>
<td>12.1%</td>
</tr>
<tr>
<td>LGC</td>
<td>-2.269</td>
<td>1,865</td>
<td>0.3541</td>
<td>227 lb./acre</td>
<td>12.2%</td>
</tr>
<tr>
<td>AR</td>
<td>-3.139</td>
<td>4,473</td>
<td>0.4650</td>
<td>314 lb./acre</td>
<td>7.0%</td>
</tr>
<tr>
<td>LA</td>
<td>-3.554</td>
<td>5,330</td>
<td>0.2548</td>
<td>355 lb./acre</td>
<td>6.7%</td>
</tr>
<tr>
<td>GA</td>
<td>-4.101</td>
<td>2,877</td>
<td>0.5970</td>
<td>410 lb./acre</td>
<td>14.3%</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>-2.636</strong></td>
<td><strong>264 lb./acre</strong></td>
<td><strong>0.5830</strong></td>
<td><strong>410 lb./acre</strong></td>
<td><strong>10.3%</strong></td>
</tr>
</tbody>
</table>

### 2015 Yield Loss estimates in lbs/acre (and % yield reduction) for every 100 aphids/leaf
- OK: 121 (6.3)
- UGC: 151 (13)
- LGC: 227 (13)
- AR: 314 (7.4)
- NLA: 355 (7.5)
- GA: 410 (15)
The plant:

Why the Yield Loss response
Courtesy of David Buntin

Fewer Heads
Less Grain on remaining

USB Sugarcane Aphid Threshold Study, Sorghum Grain yield (±SE), Georgia 2015

Means with the same letter are not significantly different (PROC GLIMMIX, α=0.05)

USB Sugarcane Aphid Threshold Study, Percentage (±SE) of plants with grain heads, Georgia 2015

Means with the same letter are not significantly different (protected LSD, α=0.05)
50 Aphids/Leaf

250 Aphids/Leaf

500 Aphids/Leaf
From Pedigo’s method $EIL = C/(V*I*D*K)$, $C =$ control cost, $V =$ $ value of grain
$K$ set at 0.95 as the proportion of the insect population controlled (taken from efficacy studies)
$I*D$ is loss estimate estimated from the slope of yield—aphid/leaf regression

Values in a feasible IPM management zone, here $ET = 0.7*EIL$

2015 ET variation 30—135 aphids per leaf
2014 ET variation 50 — 125 aphids per leaf

<table>
<thead>
<tr>
<th>2015 Example</th>
<th>Control Cost $15/acre Aphids/leaf</th>
<th>Control Cost $20/acre Aphids/leaf</th>
<th>Control Cost $25/acre Aphids/leaf</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market Value</td>
<td>Location</td>
<td>EIL</td>
<td>ET</td>
</tr>
<tr>
<td>$3.50/bushel</td>
<td>OK</td>
<td>209</td>
<td>146</td>
</tr>
<tr>
<td>$6.25/cwt</td>
<td>UGC</td>
<td>164</td>
<td>115</td>
</tr>
<tr>
<td></td>
<td>LGC</td>
<td>111</td>
<td>78</td>
</tr>
<tr>
<td></td>
<td>AR</td>
<td>80</td>
<td>56</td>
</tr>
<tr>
<td></td>
<td>NLA</td>
<td>71</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>GA</td>
<td>62</td>
<td>43</td>
</tr>
<tr>
<td>$5.00/bushel</td>
<td>OK</td>
<td>146</td>
<td>102</td>
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<tr>
<td>$8.93/cwt</td>
<td>UGC</td>
<td>114</td>
<td>80</td>
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<tr>
<td></td>
<td>LGC</td>
<td>78</td>
<td>55</td>
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<tr>
<td></td>
<td>AR</td>
<td>56</td>
<td>39</td>
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<tr>
<td></td>
<td>NLA</td>
<td>50</td>
<td>35</td>
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<tr>
<td></td>
<td>GA</td>
<td>43</td>
<td>30</td>
</tr>
<tr>
<td>$6.50/bushel</td>
<td>OK</td>
<td>113</td>
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<td>$11.60/cwt</td>
<td>UGC</td>
<td>88</td>
<td>62</td>
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<tr>
<td></td>
<td>LGC</td>
<td>60</td>
<td>42</td>
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<td></td>
<td>AR</td>
<td>43</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>NLA</td>
<td>38</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>GA</td>
<td>33</td>
<td>23</td>
</tr>
</tbody>
</table>
Use of these thresholds

✓ ID, sampling, and estimating aphid load critical

✓ Insecticide use within same or few days

✓ Excellent insecticides available

http://ccag.tamu.edu/sorghum-insect-pests/
Picking a specific threshold for you:

2015 ET variation 30—135 aphids per leaf
2014 ET variation 50—125 aphids per leaf

One responsible approach: choose an ET in the lower part of the range and adjust as you get more information

Location, insecticide cost, grain value

Sampling once (↓ ET) or twice (↑ ET) weekly

Is hybrid very susceptible (↓ ET) or less susceptible (↑ ET)??

Is it warm and dry (↓ ET) or rains and natural enemies (↑ ET)??
Integrated management

Natural Enemies + Host Plant Resistance + Good Rains =

Less damaged sorghum and higher thresholds (↑ ET)?

250 Aphids/Leaf
DK 53-67

Lady bugs,
Hover flies,
Parasitoids

70 Aphids/Leaf
DK 37-07

J. Gordy, Texas A&M AgriLife Extension

T. Ahrens, Texas A&M AgriLife Research
## Seasonal Aphid and Natural Enemy Abundance

<table>
<thead>
<tr>
<th>Date</th>
<th>Plant Stage</th>
<th>Aphids Total</th>
<th>Aphids/Leaf</th>
<th>Mummies - Aphelinus</th>
<th>Mummies - Braconid</th>
<th>Lady Beetle Adult</th>
<th>Lady Beetle Juv</th>
<th>Scymnus Adult</th>
<th>Scymnus Juv</th>
<th>Hoverfly Juv</th>
<th>Lacewing Adult</th>
<th>Lacewing Juv</th>
<th>Spider</th>
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</thead>
<tbody>
<tr>
<td>21-May-15</td>
<td>V5</td>
<td>1</td>
<td>0.01</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>0</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>28-May-15</td>
<td>V6</td>
<td>144</td>
<td>0.90</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>0</td>
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<td>0</td>
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<tr>
<td>2-Jun-15</td>
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<td>1512</td>
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<td>2</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
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<tr>
<td>10-Jun-15</td>
<td>V8</td>
<td>3992</td>
<td>24.95</td>
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<td>0</td>
<td>13</td>
<td>0</td>
<td>0</td>
<td>12</td>
<td>0</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>16-Jun-15</td>
<td>V9</td>
<td>746</td>
<td>4.66</td>
<td>23</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>0</td>
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<td>24-Jun-15</td>
<td>Boot</td>
<td>3375</td>
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<td>59</td>
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<td>0</td>
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<td>30-Jun-15</td>
<td>Bloom</td>
<td>5800</td>
<td>36.25</td>
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<td>8-Jul-15</td>
<td>Mild</td>
<td>4751</td>
<td>29.69</td>
<td>135</td>
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<td>15-Jul-15</td>
<td>Soft dough</td>
<td>2741</td>
<td>17.13</td>
<td>174</td>
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<td>13</td>
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<tr>
<td>21-Jul-15</td>
<td>Soft dough</td>
<td>3171</td>
<td>19.82</td>
<td>177</td>
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<td>2</td>
<td>13</td>
<td>37</td>
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<tr>
<td>29-Jul-15</td>
<td>Hard dough</td>
<td>1622</td>
<td>10.14</td>
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<td>5-Aug-15</td>
<td>Hard dough</td>
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</tbody>
</table>

Total number of aphids (also aphids/leaf) and natural enemies (adults and juveniles) across 8 sorghum plots (DKS 37-07 and 53-67). Same sampling effort across time.

Texas A&M Agrilife Research and Extension Center at Corpus Christi, TX College Station data in preparation, from late season regrowth.
Future work: Threshold adjustments for hybrid sensitivity

Suspect resistance R  TX2783 (2014/2015)
Dekalb DKS 37-07 (2015)
And more Future Work:

Improving penetration
  Spray tips: hollow cone, flat fan, dual fan
Harvest safeguards
  Insecticide with harvest aid
Mixed species management
  Tank mixes at critical times
You can do it: ID, detect, sample, and compare to threshold

Use of these thresholds
Values are in a feasible IPM management zone
2015 ET variation 30—135 aphids per leaf
2014 ET variation 50—125 aphids per leaf
ID, sampling, and estimating aphid load
Insecticide use within 2 days: Possible in large production
Excellent insecticides available

R. Bowling, et al., Texas A&M AgriLife
And the future looks promising for Integrated management
Natural Enemies + Sorghum Resistance + Good Rains =
Less damaged sorghum & less susceptible to aphid

250 Aphids/Leaf
Lady bugs, Hover flies, Parasitoids
70 Aphids/Leaf