

Aphid Vector



Cotton Leaf Roll Dwarf – like Virus (CLRDV) Research Review and Planning Meeting



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UNIVERSITY OF GEORGIA
EXTENSION

Cotton Aphid - *Aphis gossypii*

Vector of CLRDV & CLCDV

Overview:

- Determinants of Spread
- Cotton aphid
- Transmission of CLRDV
- Management

- Preliminary results from 2019



Aphid Biology and Ecology

- Highly polyphagous, many host plants.
- Parthenogenic reproduction, females do not mate and give birth to living young.
 - Prone to develop insecticide resistance.
- High reproductive capacity.
 - 1 female can give birth to 80 offspring.
 - Newborn aphid will begin giving birth to young in 4-5 days.
- Variable in size and color, range from light yellow to dark green or almost black.
- Winged (alate) and wingless (apterous) forms.
 - **The formation of winged types is usually in response to crowding or poor host quality.**



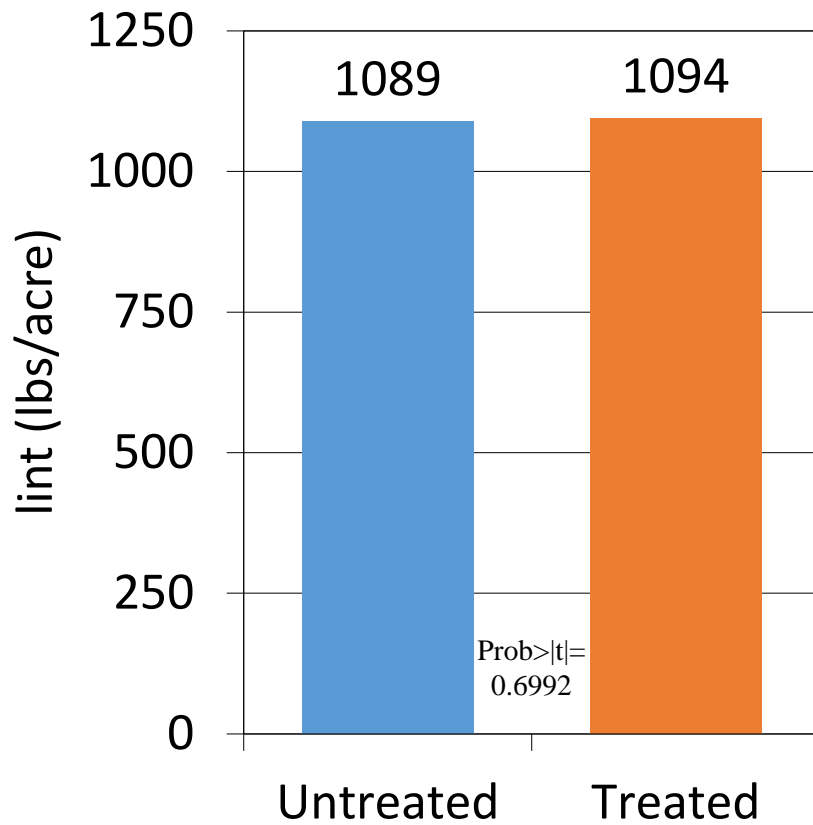
Cotton Aphid Pest Status

- Sucking mouthparts
 - Feeds on plant sap from phloem.
 - Stress inducing pest
- Severe infestations
 - Slow plant growth
 - Yellowing of terminals
 - Sooty mold develops on honeydew and interferes with photosynthesis
- Potentially infest cotton from emergence to leaves dropped.
 - 100 percent of Georgia cotton infested annually.
- Research in Georgia has not demonstrated a consistent yield response to control.
 - Effective insecticides in terms of lowering plant stress from aphids.
 - *Neozygites fresenii* fungal epizootic crashes populations (late June – mid-July)



Impact of Cotton Aphid on Yield

1998-2008 GA Cotton

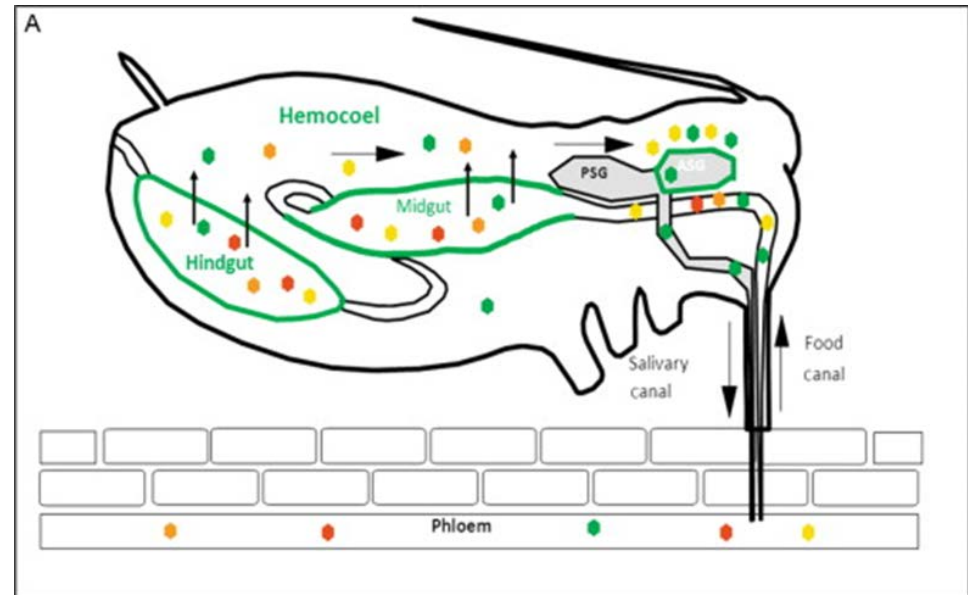


- 27 trials
- Untreated vs. treated.
 - Recommended aphicide.
 - 1-4 sprays (mean=1.85).

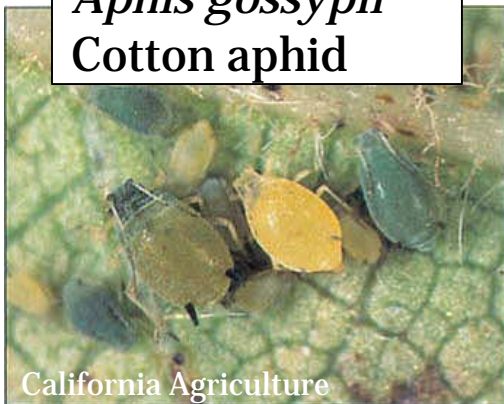


Mode of transmission for CLRDV

Persistent & Circulative



Aphis gossypii
Cotton aphid



Myzus persicae
Green peach aphid



Aphis craccivora
Cowpea aphid



Mode of transmission

Australia Cotton Bunchy Top

Acquisition:

- 5 minutes

Transmission:

- 1 hour
- After 48 hours all life stages transmitted except 1st instars.

Duration:

- Not determined

**Semi-persistent based on acquisition time*

Brazil Blue Disease

- ?

- Apterous – 1.5 hours
- Alate – 40 seconds
Increased with longer feeding

- 12 days

**Persistent*



Transmission of CLRDV in US

- **80-100% infection of CLRDV in seedlings**
- **Differences in transmission among morphs**
- **Preparing to characterize mode of transmission to verify acquisition and inoculation times.**



Temporal Occurrence of Plant Hosts and Vector Flights

Primary Spread

Secondary Spread

Virus Spread



Crop

Winter
Annuals

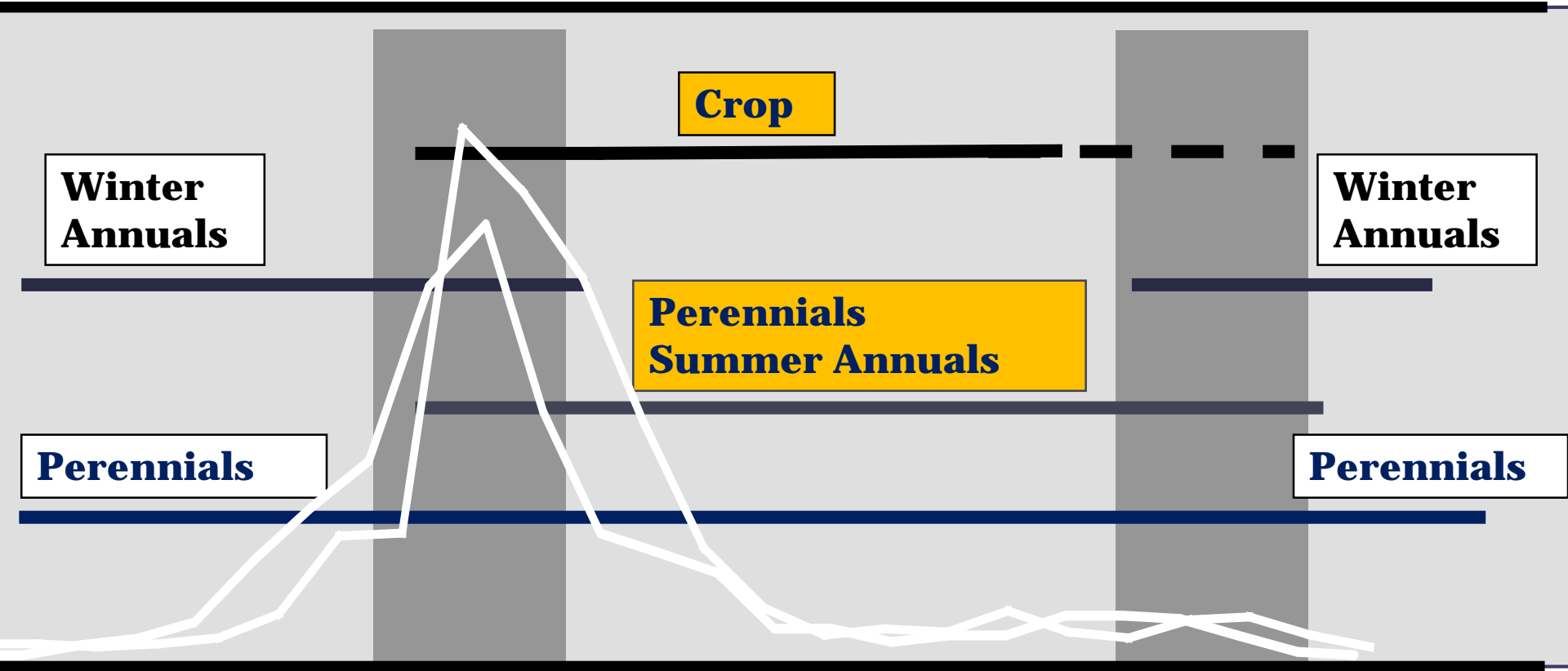
Winter
Annuals

Perennials
Summer Annuals

Perennials

Perennials

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec



Key determinants of spread

- Transmission efficiency of vectors.
- Number of vector species. – Reported: 1 in South America, 3 India.
- Amount of virus inoculum in landscape.
- Distance of inoculum from crop + dispersal behavior of vectors.
- Susceptibility of crop to virus.
- Population size of vector species / abundance.
- Seasonal population dynamics & timing of movement in landscape.
- Abiotic factors,
 - i.e. temperature (development/population dynamics), precipitation (plant growth, insect dispersal), wind (dispersal).

Susceptibility of Crop

- Other risk factors – applicable for aphid feeding damage or virus incidence:

- *Crop phenology at the time of infestation*
 - *Planting date*
- } Mature plant resistance

Younger plants usually more susceptible to virus infection

- *Severity of infestation*
- *Cultivar* – resistant to virus or aphid
- *Fertility* – aphid growth, plant health
- *Climatic conditions*



Management of Cotton Aphid in SE

- Current Recommendations for feeding injury (not virus)
- Most years populations are managed naturally by entomopathogenic fungus, *Neozygites fresenii*.
- Insecticide use avoided if at all possible
 - May be an unnecessary cost
 - May disrupt natural enemies & flare other pests
 - Insecticide resistance is a concern – resistance reported: carbamates, organophosphates, pyrethroids, cyclodiene organochlorines, phenylpyrazoles, neonicotinoids
- Insecticides to manage **primary spread** – transmit in 40 sec
- Insecticides to manage **secondary spread** ?

Objectives

1. Determine whether or not aphid management practices reduce final incidence of CLRDV.
2. Identify timing of primary spread of CLRDV into research plots.
3. Monitor aphid dispersal into cotton plots to identify timing of flights, and the species of aphids present in cotton agroecosystems.

Methods

Control: No management of *A. gossypii*

Treatment 1: Prevent colonization of crop by aphids. Beginning at the 1-true-leaf stage, make weekly applications of acetamiprid.

Treatment 2: Spray at first detection to prevent population buildup in the crop. Primary spread should occur, but secondary spread should not.

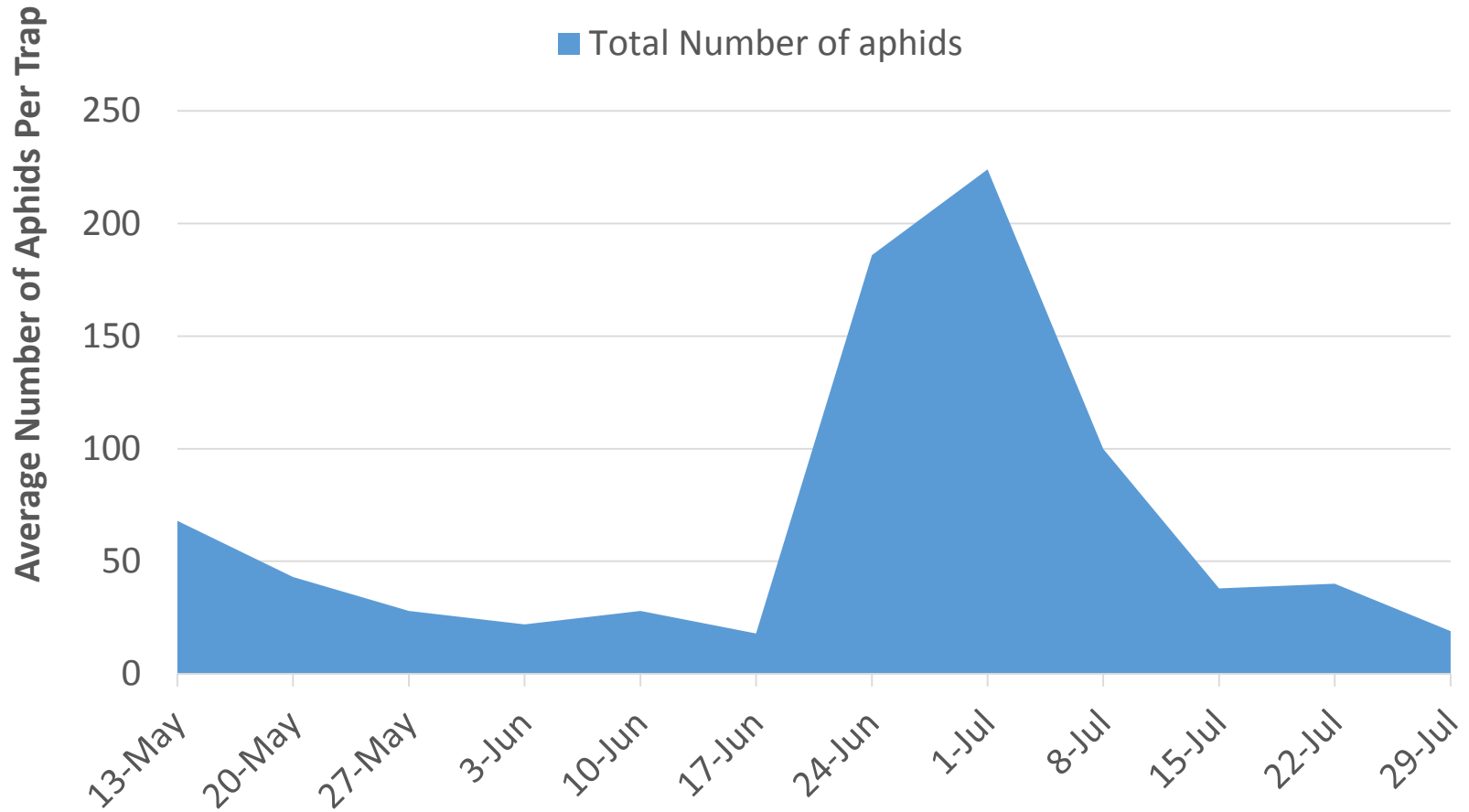
Treatment 3: Current grower practices: make a calendar-based application the first week of July.

x Two planting dates

Preliminary Results

- 100% of plants infested during peak aphid flights.
- Weekly insecticide sprays did not reduce colonization by aphids.
- Aphid management did not reduce final incidence of CLRDV.
- No yield differences were observed between control plots and plots managed for aphids.

Aphid Trapping and Sentinel Plants Brewton, AL



Aphids on Seedling Cotton



June 18, 2018



June 19, 2019

Aphids on Seedling Cotton



June 21, 2019
(Planted June 17, 2019)

Aphids on Seedling Cotton



July 1, 2019
(Treated June 21 and June 27)

Conclusions

- **Transmission of CLRDV by cotton aphid has been confirmed.**
- **Preliminary data shows that management of aphid populations with insecticides does not:**
 - **Eliminate aphids from field**
 - **Reduce incidence of CLRDV**
 - **Increase yields**

Knowledge gaps exist:

- Mode of transmission – how quickly can CLRDV isolates in the US be acquired and transmitted?
 - *In progress*
- Virus localization in plant tissue and disease progression.

Major knowledge gaps exist:

Aphid seasonal dynamics:

- Characterize full season population dynamics of aphids in cotton
- Aphid population size and infestation levels not uniform
 - **Impact timing & magnitude of spread.**
- Population reductions caused by fungal epizootics and insecticide do not eliminate aphids from the system.
- Aphid vector species in US:
 - **How many vector species?**
 - **What are their geographic ranges?**
 - **What are their crop and non-crop host plants?**

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COTTON INCORPORATED

