INVESTIGATING THE IMPACT OF PLANTING DATE AND COTTON APHID MANAGEMENT ON THE FINAL INCIDENCE OF *COTTON LEAFROLL DWARF VIRUS*

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Abstract

Cotton leafroll dwarf disease (CLRDD), caused by *Cotton leafroll dwarf virus* (CLRDV), is an emerging aphid-transmitted virus in the U.S. that has been reported in AL, GA, MS, SC, and TX (Aboughanem-Sabanadzovic et al. 2019, Alabi et al. 2020, Ayelar et al.2018, Huseth et al. 2019, Tabassum et al. 2019, Wang et al. 2020). *Aphis gossypii* (Glover), the cotton aphid, is the reported vector of CLRDV in South America and India (Cauquil and Vaissayre, 1971, Michelotto and Busoli 2007, Mukherjee et al. 2012), and has been shown to transmit CLRDV in the U.S. (McLaughlin et al. 2020). Annual infestations of *A. gossypii* occur in the Southeast and Mid-south, but natural population reductions occur from epizootics of *Neozygites fresnii* (Abney et al. 2008). Management of this pest with insecticides can also flare secondary pests by disrupting natural enemies, and therefore, is only recommended if populations persist late-season to prevent honeydew contamination of lint. The emergence of CLRDV is causing a re-evaluation of the benefits of aphid management as a component of CLRDD management. Knowledge on aphid population dynamics related to virus spread to cotton crops is needed to determine whether or not aphid management strategies will reduce the spread of CLRDV to cotton. This includes characterizing the role of primary spread (transmission that occurs as a result of aphids moving into the crop from the surrounding landscape) versus secondary spread (the transmission that occurs as populations of vectors within the crop grow and spread throughout the field) on final virus incidence. If transmission of U.S. isolates of CLRDV by alate aphids occurs in under 40 seconds, as reported in Brazil (Michelotto and Busoli 2007), then insecticides won't be effective in reducing secondary spread. The mode of transmission of U.S. CLRDV by U.S. populations of *A. gossypii* is understood, but not available at this time (Heilsnis et al. 2020). In pathosystems where secondary spread is a significant factor contributing to final virus incidence, management of vector populations can reduce final incidence of the virus and risk of disease.

Research was conducted in AL and GA in 2019 to: 1) Monitor aphid dispersal into cotton plots and the species of aphids present in cotton agroecosystems; 2) Identify timing of primary spread of CLRDV into research plots; and 3) Determine whether or not aphid management practices reduce final incidence of CLRDV. For the first objective, weekly aphid trapping was conducted using yellow pan traps that were placed around the field borders beginning in May and continuing until the end of August. Objective two was only conducted in AL. Virus spread was monitored weekly using cohorts of healthy, greenhouse grown three-true leaf cotton that were placed on the field borders for one week to expose them to field conditions. After one week sentinel plants were collected from the field, grown insect-free in a greenhouse for at least 1 month, and then tested for CLRDV using PCR. For objective three, four insecticide spray regimes were evaluated. Treatments included plots that were not sprayed with insecticide, plots sprayed weekly with acetamiprid beginning the first true-leaf stage, plots sprayed weekly with acetamiprid beginning when colonization occurred at the end of June, or plots sprayed once with acetamiprid the second week of July before population crash due to *N. fresnii*. A final insecticide spray was made to all plots after fungal epizootics naturally reduced populations in the non-sprayed plots in mid-July. Final virus incidence was determined by sampling ten plants per plot and confirming the presence of CLRDV using PCR. Yield was collected.

Aphis gossypii was the predominant species in AL and GA, and was captured every week. Peak flights occurred the weeks of June 24-July 1 at both locations, and CLRDV was detected in sentinel plants that were in the field during the four consecutive weeks that coincided with this dispersal event. CLRDV was also detected in sentinel plants during the weeks of May 13 and 20, when *A. gossypii* was not the most abundant species present, and at the end of August when trap captures of all species was low. Insecticide applications did not reduce final incidence of CLRDV in AL or

GA, and final virus incidence ranged from 60-100% in these plots. No significant differences in yield were observed among treatments. Insecticide applications were also not effective at eliminating aphids from the plots. During peak aphid flights 100% of the plants in all plots in AL had aphids present, and infestations ranged from 70-100% infested in GA during this time. These results suggest that aphid management won't be an effective strategy for reducing CLRDV transmission where aphid populations are high enough to result in most plants becoming infested during colonization events. More information is needed to understand variation in the timing and magnitude of *A. gossypii* flights across the cotton belt and identify the role of other aphid species in the epidemiology of CLRDV.

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