COTTON APHID MANAGEMENT ISSUES IN LOUISIANA DURING 2007

B. R. Leonard
K. Emfinger
P. Price
LSU AgCenter, Macon Ridge Station
Winnsboro, LA
K. Fontenot
J. Hardke
LSU AgCenter
Baton Rouge, LA

Introduction

Louisiana cotton, *Gossypium hirsutum* L., fields are subjected to a complex of arthropod pests that are capable of reducing the economic value of this crop (Bagwell 2005, Williams 2006). Several species of aphids can be found on cotton plants, but the melon or cotton aphid, *Aphis gossypii* Glover, is the primary aphid pest across the U.S. cotton belt. Cotton aphid may infest plants throughout the entire production season. This insect is generally considered an occasional or secondary pest, but infestations can reach levels that influence normal plant development, especially during periods of excessive environmental stress. Cotton aphids in Louisiana are typically a problem during the pre-flowering to flowering stages of plant development. The 'honeydew' produced by these insects is usually not a problem during this time of the season. However, in Texas and Oklahoma, the 'honeydew' produced by late-season infestations can contaminate seed cotton in open bolls, and in some instances affect fiber quality (Slosser et al. 1989).

Cotton aphids are naturally controlled by a variety of biotic factors (predators, parasitoids, and pathogens) which generally suppress populations from building to economic infestations. Unfortunately, problems with this pest can be induced by agronomic and pest management practices applied to cotton fields (Slosser et al. 1989, Leonard and Lorenz 2007). Many of these factors interact concurrently with local environmental conditions, and no single event is usually responsible for inducing cotton aphid outbreaks. Historically, the use of non-selective insecticides that disrupts natural biological control agents of cotton aphid has been commonly associated with cotton aphid infestations. The entomopathogenic fungus, *Neozygites fresenii,* has been the primary factor regulating mid-season cotton aphid populations across Louisiana during the past two decades (Steinkraus et al. 1995). Epizootics in cotton aphid populations have normally developed during late June to mid-July and effectively eliminated any subsequent problems with this pest for the remainder of the season.

Numerous reports have indicated that the performance of insecticides used to control cotton aphids declines after several seasons of use. Populations of this pest have demonstrated resistance to a wide range of insecticides across many states (Grafton-Cardwell 1991, Kerns and Gaylor 1992, O'Brien and Graves 1992). In recent years, only a limited number of products (neonicotinoids and flonicamid) have remained consistently effective against this pest. Laboratory populations of cotton aphid have already demonstrated resistance to the neonicotinoid, imidacloprid, (Wang et al. 2002), but no confirmation of resistance has been detected in U.S. populations collected from cotton.

During 2006, cotton aphids were a significant pest problem in Mid-South cotton fields. In Louisiana, cotton aphids infested >491,000 acres, and >356,000 were treated with insecticides during that year (Williams 2007). During 2007, the number of infested and treated acreage was considerably lower. During 2006-07, a combination of favorable environmental conditions, agronomic practices, and insecticide use strategies likely contributed to cotton aphid infestations in Louisiana cotton fields. The objective of this report is to briefly review the cotton aphid control problems experienced during 2007.

Insecticide Performance Against Louisiana Cotton Aphid Populations

Cotton aphid infestations generally were sporadic and relatively isolated during 2007. The presence of cotton aphids in fields appeared somewhat earlier than that observed during 2006. High numbers (>300/terminal leaf) were recorded on cotton seedlings that were just beginning to square. During late May and continuing throughout June, instances of unsatisfactory control with imidacloprid (Trimax Pro 4.44SC), thiamethoxam (Centric 40WG), and acetamiprid (Intruder 70WP) were reported by several agricultural consultants in Louisiana. Additional treatments of these insecticides as well as flonicamid (Carbine 50WG) were applied to many of those fields with persistent infestations. Field trials with the neonicotinoids in 2007 indicated unsatisfactory control (<70% reduction). These results ware consistent with the 2006 data and showed a decline in insecticide performance compared to that for those same products used in previous years.

Bioassays with Field Collections of Cotton Aphid

Samples of cotton aphids were collected from several locations that experienced less than satisfactory control with the recommended neonicotinoids during 2007. Some of the fields were sampled prior to the initial application of insecticides. Other fields were not sampled until 7-10 days after treatment (DAT). The entire leaf or group of terminal leaves infested with cotton aphid colonies were placed in brown paper sacks, sealed with tape, and transported to the laboratory. These samples were maintained in the bags for one night. The following day, cotton plants were treated with Intruder 70WP (1.0 oz [form.]/acre), Centric 40WG (2.5 oz [form.]/acre), and Carbine 50WP (2.0 oz [form.]/acre). The first fully expanded leaf was excised from plants (10-20/plot), placed in a plastic Petri dish, and infested with healthy cotton aphids (5-10/leaf) from the field collections. At 72 hours after infestation on treated or non-treated (control) leaves, insect mortality was recorded.

Cotton aphid mortality on non-treated leaves was <28% in all tests. One series of bioassays was performed on a collection from Concordia parish which had been treated 5 days earlier with Intruder 70WP (0.9 oz [form.]/acre). Mortality levels for this collection exposed to Intruder 70WP (47.5%), Centric 40WG (62.4%), and Carbine 50WP (74.9%) were considerably lower than expected for all insecticides. In addition, those leaves on which reproduction had occurred were recorded. In the non-treated plots, reproduction was observed on 78.3% of the infested leaves. On insecticide-treated leaves, reproduction ranged from 5.7-15.6%. This observation has important significance and suggests that some of the cotton aphids surviving a field rate of insecticide can continue to reproduce in the presence of an insecticide. An additional sample of this collection was transported to scientists at Syngenta Crop Protection's research center located near Vero Beach, FL. Those cotton aphids were exposed to a range of thiamethoxam (Centric 40WG) concentrations. The results for this colony showed a 3-fold difference in LC_{50} values compared to that for a susceptible cotton aphid colony.

Summary

Cotton aphid populations in Louisiana were isolated, and relatively few acres were infested with this pest during 2007. Several instances of unsatisfactory control with the neonicotinoids were reported, but it is unlikely that cotton yields were affected in the infested fields. Eventually by mid-to-late July, an epizootic from the entomopathogenic fungus, *Neozygites fresenii,* suppressed cotton aphids for the remainder of the season. The results of field and laboratory tests screening the neonicotinoids indicate that the susceptibility of Louisiana cotton aphid populations may be shifting. The current data are limited in scope and do not necessarily support the development of neonicotinoid-resistance in field populations. The history of insecticide resistance in cotton aphid should provide ample warning of the potential problems in the near future. A coordinated survey of neonicotinoid susceptibility in cotton aphid populations across the cotton belt should be initiated during 2008. Those results should be used to develop and implement logical IRM strategies for cotton aphid.

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