Again, with either "spray-in-the-fall-to-keep-it-small" or "planting-time-clean-up" control programs, the "real meat" of the weed control program is Clarity or 2,4-D, applied during "warm" late-winter weather in February or March. Fall applications, or planting time applications will fail if they aren't in a program with a growth regulator.

One final recurring recommendation is Liberty Link cotton. Spraying Ignite twice, in the cotton crop, when temperatures are warmer usually makes for excellent marestail control. However, growers should be aware that for adequate pigweed control, a residual preemergence treatment should be used and Ignite must be sprayed in an extremely timely manner.

Cotton Aphid Population Dynamics And Control Strategies In Conservation Tillage Cotton Fields

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Introduction

The cotton aphid, *Aphis gossypii* Glover, has been a cotton, *Gossypium hirsutum* L., pest in the United States since 1854. Historically, significant infestations of this insect have been induced with pesticides, but cotton aphid usually has been considered a secondary pest problem. The use of non-selective insecticides disrupts natural biological control agents of cotton aphid. Populations of these pests then reach levels that can influence normal plant development during vegetative and reproductive growth stages. In addition, 'honeydew' produced by these insects during boll opening can contaminate seedcotton, and in some instances, reduce harvest efficiency and affect fiber quality in open bolls.

Reports of significant infestations of this pest have been randomly scattered throughout the scientific literature. Prior to the 1940's, cotton aphid was associated with applications of the inorganic insecticide, calcium arsenate, applied to control boll weevil, *Anthonomus grandis grandis* Boheman. In the mid-1980's, this insect appeared to become an annual problem on cotton in selected states across the U.S. cotton belt. The occurrence of treatable infestations in many areas was associated with frequent applications of pyrethroids for caterpillar pest control or applications of malathion used in boll weevil eradication programs. In 1991, the cotton aphid was considered the most significant cotton pest of the U.S. Cotton Belt due to failures of recommended insecticides. The significance of cotton aphid as a cotton pest during the previous decade was associated with the development of insecticide resistance in populations across numerous states. Many labeled insecticides failed to provide satisfactory control and were removed from Cooperative Extension Service recommendations. Presently, only a limited number of products remain consistently effective against this pest. During 2006, cotton aphids were a significant pest problem in Mid-South cotton fields. Reports of unsatisfactory control with a range of insecticides were common, and additional oversprays were applied to many fields.

Cotton aphid infestations usually are detected more often on seedling plants in conservation tillage cotton production systems compared to plants in conventional tillage systems. Nearly all of Louisiana's cotton fields are exposed to very limited tillage practices and are planted to herbicide-tolerant (Roundup ready) cotton varieties. Cotton aphids in conservation tillage fields consistently reach peak population densities more rapidly compared to cotton aphids in conventional tillage fields. This occurrence can trigger insecticide applications earlier in the season and increase the frequency of treatments for cotton aphid. The objectives of this report are to briefly review a few selected factors that contribute to cotton aphid population dynamics and illustrate the performance of recommended insecticide use strategies.

Key Factors Influencing Cotton Aphid Population Dynamics

Cotton aphid population dynamics can be influenced by both agronomic and pest management practices. A number of biological and operational factors, including tillage practices, cotton varieties, seeding dates, solar radiation, leaf moisture concentrations, plant spacing, plant nutrition/soil fertility levels, host plant diversity, insecticide use strategies, insecticide-resistant populations, and intensity of natural biological enemies, can influence cotton aphid populations and their effects on cotton plants. However, this summary will focus on the contribution of conservation tillage practices and insecticide use strategies to cotton aphid population

dynamics in cotton fields.

Conservation Tillage

Higher densities of cotton aphids on cotton seedlings have been consistently observed in no tillage or conservation tillage systems compared to conventional tillage systems across the Southeastern and Mid South regions. Cotton aphids migrate to cotton fields after plant stands have become established. Seedling growth and development (plant height, leaf area, etc.) also has been significantly improved in conservation tillage systems. As a result, the physical attractiveness of plants as well as residue from native vegetation or previous crops influences insect population dynamics.

During a five year study period in Louisiana, cotton aphid peak densities exceeded 500 insects/sample (10 plants) in the reduced tillage plots compared to fewer than 350 insects/sample (10 plants) in the conventional tillage plots (Fig 1). In addition, the population increase generally was delayed by several days in the conventional tillage system. During these tillage studies, populations declined abruptly in July because of an epizootic produced from the entomopathogenic fungus, *Neozygites fresenii*. Population densities remained low for the remainder of the season. Considerable work has indicated that no significant differences in cotton aphid numbers occur on cotton plants in native vegetation and winter cover crop plots, regardless of tillage system.

In another series of tillage studies in Louisiana, cotton aphid-infested plants ranged from 14.7% to 96.1% during 1996 to 1998 (Table 1). Significant differences in cotton aphid-infested cotton plants were observed among tillage systems in all years. In 1996, 1997, and 1998, conventional-till plots contained significantly fewer aphid infested plants than both ridge tillage and no tillage plots. In 1997, ridge tillage plots contained significantly fewer cotton aphidinfested plants compared to no tillage plots.

During both of these projects, red imported fire ant (RIFA), *Solenopsis invicta* Buren, densities were surveyed and found to be higher in the no tillage plots compared to that in the conventional tillage plots. Tillage reduces the incidence of RIFA in cotton fields by disturbing the soil used to form mounds. RIFA colonize no tillage plots and appear to reduce predation of cotton aphids from natural enemies.

Insecticide Use Strategies

The current patterns of insecticide use in many Mid-South cotton fields could increase cotton aphid population outbreaks and subsequent control problems. A single application of a product for a specific pest likely will not stimulate population growth or significantly influence the efficacy of products applied for cotton aphid control. However, the most common sequence of product applications used on pre-squaring cotton may be partially responsible for the cotton aphid problems that occurred during 2006.

Recently, insecticide seed treatments (IST) including Gaucho 480FS, Cruiser 5SL, or Avicta have replaced the most common granular soil-applied insecticide, Temik 15G on considerable cotton acreage. This widespread acceptance of seed treatments increases the efficiency of planting operations. However, the active ingredients (AI) in the aforementioned seed treatments are in the same class of chemistry, neonicotinoids, as the majority of the insecticides used for foliar oversprays to control cotton aphids later in the season. Oversprays to control pests on cotton seedlings usually are non-selective organophosphate (OP) compounds (Acephate [Orthene], Bidrin, dimethoate). Many cotton aphid populations are resistant to many of these products and populations may actually increase in an OP-treated field by eliminating predators and parasitoids of cotton aphid. Current use of the OP, malathion, or pyrethroid insecticides used for boll weevil eradication and caterpillar pests, respectively, are likely "flaring" cotton aphids. Foliar applications of the same products used against cotton aphid are also used to manage *Lygus spp*. in cotton fields. Cotton aphids that migrate to newly emerged cotton seedlings can be exposed to multiple applications of products that may either promote population growth or reduce susceptibility to the primary insecticides (neonicotinoids) used for their control.

Many cotton fields in Louisiana and Mississippi experienced less than satisfactory control of cotton aphids with recommended products during 2006. Foliar treatments of the recommended neonicotinoids, Centric, Intruder, and Trimax Pro, have effectively managed cotton aphids across the entire cotton belt since their registration over five years ago. However, a single application of these products in 2006 provided less than 75% control of cotton aphids and was lower than that previously documented in Louisiana (Table 2). During the 2006 season, Louisiana and Mississippi were awarded emergency clearance approval (EPA, FIFRA Section 18's) for carbofuran to control cotton aphids due to restricted quantities of a novel aphicide, flonicamid (Carbine).

Summary

A significant agronomic factor influencing cotton aphid populations appears to be a reduction in tillage practices. Reduced tillage practices increase cotton aphid densities earlier in the season and produce higher peak populations compared to that in conventional tillage plots. Therefore, cotton aphid management with insecticides may be initiated earlier in conservation tillage systems. The current early season insecticide use strategies likely are associated with generating higher populations and reducing susceptibility to the neonicotinoid products. Pest managers and producers should recognize the potential of these factors in increasing problems with cotton aphids. An effective IPM strategy for cotton aphids must include the discriminate use of chemical control strategies for pest problems.

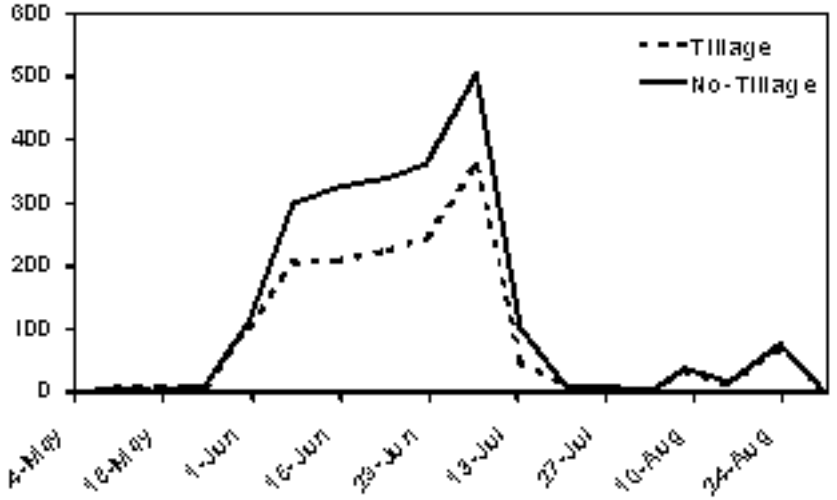

Fig. 1. Effect of tillage systems on cotton aphid populations in Louisiana cotton fields, 1994-98. (Adapted from Leonard et al. 2000. Proc. 2000 South. Conserv. Till. Confer. Sustain. Agric. pp. 43-44. Louis. Agric. Expt. Sta. Pub. 00-86-0205.)

Table 1. Effects of Tillage Systems on Cotton Aphid Infestations in Louisiana, 1996-1998.

	% Cotton Aphid-Infested Fields		
Tillage System	1996	1997	1998
Conventional tillage	74.4b	74.4c	14.7b
Ridge tillage	93.1a	89.7b	22.6a
No tillage	87.5a	96.1a	22.7a
(P>F)	<0.01	<0.01	0.02

Means in columns followed by the same letter are not significantly different (Fishers LSD, P=0.05).

Table 2. Insecticide Efficacy Against Cotton Aphid in Louisiana During 2006.

	Rate/Acre	% Aphid Control	
Treatment/Form	(lb AI)	2 DAT	7 DAT
Intruder 70WP	0.05	64.5ab	76.7a
Centric 40WG	0.05	52.9b	70.3ab
Trimax Pro 44L	0.047	<42.7b	49.9b
Prandan 4F	0.25	88.2a	88.1a
Treatment (P>F)		0.0002	0.0001

Means in columns followed by same letter are not significantly differ (P=0.05, DMRT).