

# INFLUENCE OF CONSERVATION TILLAGE ON COTTON INSECT PEST ECOLOGY: A CASE STUDY WITH COTTON APHID, *APHIS GOSSYPHII* GLOVER

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## INTERPRETIVE SUMMARY

### INTRODUCTION

Conservation tillage systems provide a favorable micro-environment for insect populations by increasing host plant density and mediating soil moisture and temperature extremes. Population densities of a wide range of pests and beneficial insect complexes are affected by conservation tillage practices for crops including cotton, soybean, and field corn. Conservation tillage systems for cotton are becoming widely accepted, but limited information is available to describe the impact of these systems on cotton insect pests. Agronomic practices for cotton production have a significant impact on insect pest diversity and density. Therefore, if the ecology of insect pests is modified by a change in tillage systems, integrated insect pest management strategies will need to be refined. The objective of this study was to evaluate the effects of conservation tillage systems on cotton aphid, *Aphis gossypii* Glover, population dynamics.

### LITERATURE SUMMARY

Numerous insect pests are capable of injuring cotton annually. Populations of several caterpillar pests, including bollworm, *Helicoverpa zea* (Boddie); tobacco budworm, *Heliothis virescens* (F.); armyworms, *Spodoptera* spp., and cutworms, *Peridroma* spp. and *Agrotis* spp.; are either directly or indirectly influenced by conservation tillage practices. Reducing tillage promotes survival of the larval and pupal stages of these pests when they complete their

development just below the soil surface. Spring tillage has been recommended for many years as a cultural control strategy to reduce numbers of these insects before they emerge from their overwintering habitat in the soil. A non-caterpillar pest, the cotton aphid, has also been observed in higher numbers on cotton plants in conservation tillage systems compared with numbers on plants in conventional tillage systems. Cotton aphids are currently considered to migrate to cotton fields after plant stands have become established. Therefore, it is more likely that cotton aphid populations increase due to an increase in plant residue on the soil surface as a result of reduced tillage. Cotton seedling growth and development (plant height, leaf area, etc.) also has been significantly improved in conservation tillage systems. The physical attractiveness of plants, as well as residue from native vegetation or previous crops, has been shown to influence insect population dynamics.

### STUDY DESCRIPTION

Studies to monitor cotton aphid populations in conservation tillage production were conducted at the LSU Agricultural Center's Macon Ridge Research Station located near Winnsboro, Louisiana during the 5-year period, 1994-1998. Tillage treatments that were used in these studies included conventional and reduced tillage (fall/spring re-bedding, ridge-tillage, no-tillage). Winter cover crops included wheat, hairy vetch, Austrian winter peas, and crimson clover, as well as native winter vegetation. Cotton aphid densities were monitored weekly beginning at 7 days after cotton seedling

emergence to crop termination by sampling 10 whole plants or plant terminals (all apical shoot growth above and including the first fully expanded leaf) from each plot.

### Applied Questions

#### What are the effects of reduced tillage practices and winter cover crops on cotton aphid densities in cotton?

During the 5-year study period, cotton aphid peak densities exceeded 500 insects/10-plant sample in the reduced tillage plots compared with <350 insects/10 plant sample in the conventional tillage plots. The seasonal increase in cotton aphid density occurred during early June and was similar each year. There were no significant differences in cotton aphid densities between native vegetation and winter cover crop plots, regardless of tillage system. The most important agronomic factor influencing cotton aphid populations appeared to be a reduction in tillage practices.

#### Is the natural control of cotton aphids by the insect pathogenic fungus, *Neozygites fresenii* Nowakowski, influenced by reduced tillage practices?

During each year of the study, populations declined abruptly in July because of an epizootic from the fungus. Population densities remained low for the remainder of the season. The spatial and temporal occurrence of this fungus was not influenced by tillage practices or winter cover crops.

#### What is the relationship of red imported fire ant, *Solenopsis invicta* van Buren, populations to reduced tillage practices and cotton aphid densities?

Red imported fire ant (RIFA) densities were surveyed in this study during 1998 and 1999 and were found to be higher in the no-tillage plots when compared with that in the conventional tillage plots. The highest numbers of cotton aphids were generally

recorded in those plots infested with RIFA. RIFA colonize no-tillage plots and appear to reduce predation of cotton aphids from natural enemies. Tillage reduces the incidence of RIFA in cotton fields.

### SUMMARY

Reduced tillage practices increase cotton aphid densities earlier in the season and produce higher peak populations compared with that in conventional tillage plots. Natural control of cotton aphids by an insect pathogenic fungus is not influenced by tillage, while RIFA numbers increase in response to a reduction in tillage. Based on these results, cotton aphid management with insecticides may be initiated earlier in conservation tillage systems. Otherwise, no major changes in cotton aphid management recommendations between conventional and conservation tillage systems are necessary at this time.

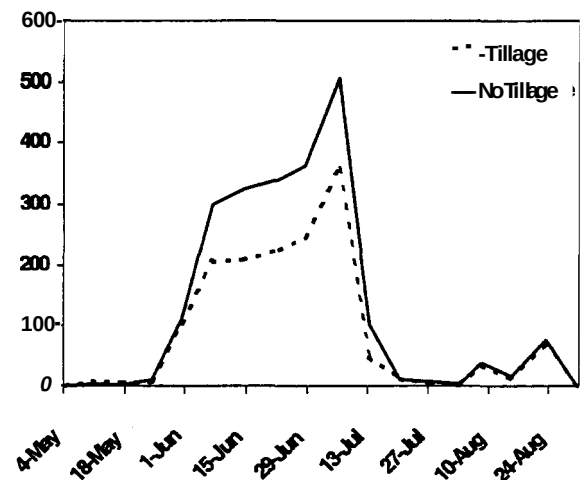


Fig. 1. Effect of tillage systems on cotton aphid population densities in Louisiana cotton fields, 1994-98.