# LABORATORY AND FIELD EVALUATIONS OF IMIDACLOPRID AND THIAMETHOXAM AGAINST GWSS ON CITRUS AND GRAPES

***Project Leaders:***
*Nick Toscano*
*Department of Entomology*
*University of California*
*Riverside, CA 92521*

*Steven J. Castle*
*USDA-ARS*
*Phoenix, AZ*

***Cooperators:***
*Jianlong Bi, Frank Byrne, Nilima Prabhaker*
*Department of Entomology*
*University of California*
*Riverside, CA 92521*

## INTRODUCTION

The development of the neonicotinoid class of insecticides represents a powerful addition to our pest management capabilities. They are safer and more effective insecticides (Casida and Quistad, 1997) due to their lower mammalian toxicities, yet they exhibit higher toxicities against target insects. This permits their use at comparatively low rates and helps to limit environmental contamination. As systemic insecticides, they are more target-specific than conventional broadcast insecticides. This is because soil-applied neonicotinoid insecticides are taken up by plant roots and translocated throughout a plant. Thus, their toxic activity is by and large restricted to plant-feeding insects only. With their putative lower impact on beneficial insects relative to conventional insecticides, the neonicotinoids should be good candidates for incorporation into IPM programs for glassy-winged sharpshooter.

The potential of neonicotinoids to protect citrus and grapes and other perennial crops against glassy-winged sharpshooter is only beginning to be tested. Worldwide, imidacloprid has proven highly effective against a range of insects, but with especially strong performance against sap-feeding insects in both annual and perennial crops. The more recent products such as thiamethoxam and acetamiprid have also shown strong performance against homopterans and other taxa. For each of these insecticides, clearer understanding of their activities against targeted insect pests will lead to more proficient usage.

The overriding goal of research addressed by this project is to better understand the activity of neonicotinoid insecticides against glassy-winged sharpshooter in citrus and grapes. Direct effects on GWSS such as mortality and anti-feedant over the course of a treatment application need to be quantified. These are in turn dependent on the uptake and distribution dynamics within a tree or grapevine over the effective period of the treatment application. Knowledge of the duration and quality of protection afforded to large and complex plants such as mature citrus trees or grapevines is essential to optimizing the performance of neonicotinoid insecticides.

## OBJECTIVES

1. Evaluate the titre and distribution of imidacloprid and thiamethoxam within citrus trees and grapevines over time.
2. Develop and conduct bioassays of GWSS on field-treated citrus trees and grapevines tissue and relate mortality to plant titres of imidacloprid and thiamethoxam.
3. Evaluate the behavior of GWSS adults and nymphs of citrus and grapevines treated with neonicotinoid insecticides.
4. Determine the impact of neonicotinoid insecticides on GWSS populations.

## RESULTS

Two varieties of mature citrus, lemons and Valencia oranges, were treated with imidacloprid on 10 April 2001 at UC Riverside. Imidacloprid (Admire®) was applied through the irrigation system equipped with microjet emitters at a rate of 32 oz. per acre to 36 orange trees and 22 lemon trees. Beginning 25 April, GWSS samples were collected weekly with a bucket sampler from 12 each of treated and untreated orange trees, and from 7 each of treated and untreated lemon trees. Collections were sorted by nymphal stage and adult sex (for brevity, presented as nymphs and adults) and used to compare treatment densities (Fig. 1). Populations of GWSS consisted almost entirely of nymphs until mid-June in both citrus varieties. There was little obvious treatment effect until 6 weeks post application, 25 May, when a significant drop in mean nymphal densities occurred relative to the untreated trees and to earlier samples from treated trees (Figure 1). Thereafter, nymphal densities declined progressively and at a greater rate compared to the untreated trees where conversion to adults also contributed to lower nymphal densities. Densities of GWSS adults in oranges begin to increase in mid-June as the earliest of the spring generation of GWSS completed their development (Figure 1). Initially, similar densities of GWSS adults occurred in both treated and untreated trees as much flight activity and movement between trees was observed orchard-wide. By mid-July, however, a significant drop in adult densities on treated oranges occurred and has been sustained ever since (Figure 1). The phenology of GWSS in lemon in terms of nymphal and adult occurrences was similar to that observed in orange (Figure 2). However, there was little obvious impact of the imidacloprid treatment on nymphal densities relative to the untreated lemon trees. In part, this could be due to slower uptake of the imidacloprid by lemon trees because of rootstock incompatibility (Cockeram, per. com.). The most obvious manifestation of this incompatibility is the general state of decline afflicting the lemon trees orchard-wide. But the impact of imidacloprid treatment became apparent by late July as adult densities increased on untreated lemon trees while remaining static on treated trees (Fig. 2).

In another study, colonization rates of GWSS on young Valencia orange trees treated with imidacloprid, thiamethoxam, dimethoate, or left untreated were monitored through summer, 2001. The young nursery trees were transported to a greenhouse, randomly assigned and divided into the 4 treatment groups, then treated using the appropriate rates for container plants for each insecticide. After 2 weeks in the greenhouse following treatment, the young trees were transplanted 18 May 2001 into 12 groups of 4 trees within a mature citrus orchard heavily infested with GWSS. Visual counts of GWSS on each tree began 1 June and continued each week through mid-August. Beginning 15 June, the number of dead GWSS beneath each tree was assessed. Although there was much variability among the 12 groups, densities of GWSS adults were consistently highest on thiamethoxam-treated trees and lowest on imidacloprid-treated trees (Figure 2a). This difference in relative densities between the 2 treatments was also apparent with the greater number of dead adults found beneath thiamethoxam-treated trees (Figure 2b).

**Figure 1.** Densities of GWSS nymphs and adults on imidacloprid treated and untreated Valencia orange (a) and lemon (b) trees. densities

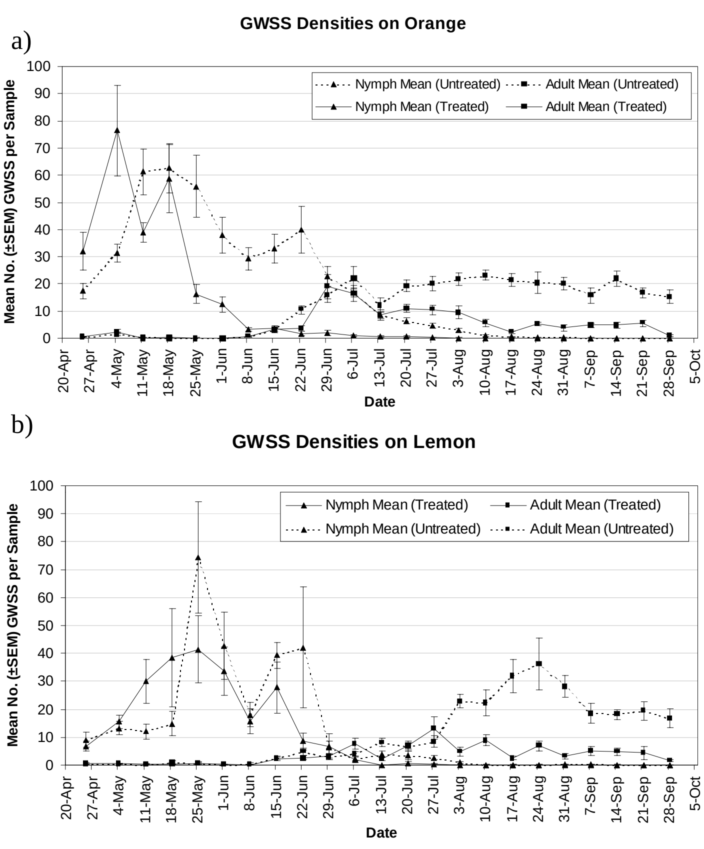
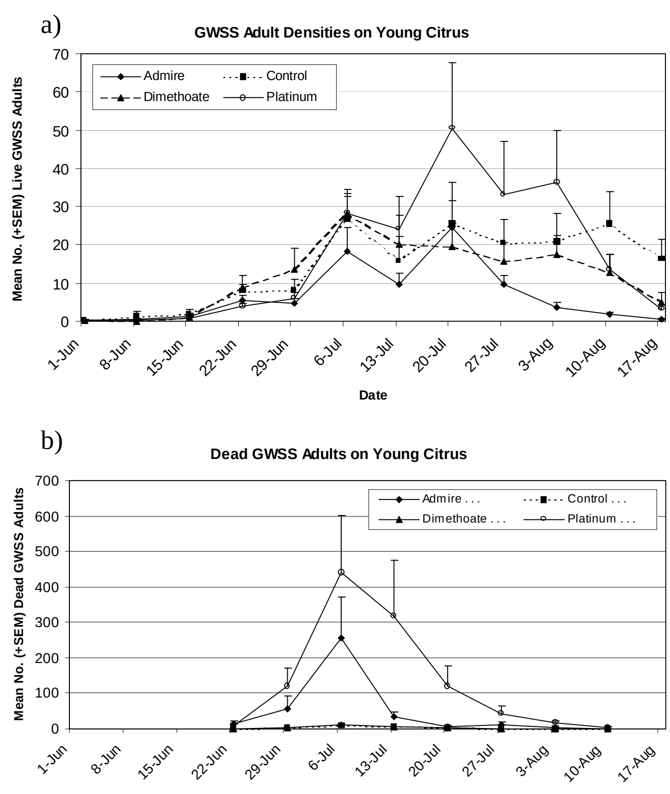



**Figure 2.** Live (a) and dead (b) GWSS adult on young citrus trees treated with 1 of 3 systemic insecticides.

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