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

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INTRODUCTION

Much evidence has accumulated over the past few years pointing to the significant role played by imidacloprid (Admire®) in reducing GWSS populations. In regions of California where imidacloprid has been used in area-wide control programs, populations of GWSS have declined substantially relative to their pre-action levels. For example, remnant GWSS infestations in Temecula appear to be associated primarily with untreated tracts of vegetation such as organic citrus, while their densities in conventional orchards and vineyards are extremely low. Similarly, GWSS population densities have been substantially reduced in southern Kern County as an outcome of the General Beale Road project. In contrast, other areas with high populations of GWSS such as Ventura/Fillmore and Riverside/Redlands that have not yet participated in area-wide control programs still retain high GWSS populations. The significant reduction of GWSS densities in only those regions where concerted action has been mounted is persuasive, even if it is only indirect evidence of the role that imidacloprid treatments have played in curtailing GWSS populations.

By measuring temporal and spatial dynamics of imidacloprid uptake and distribution in mature citrus trees and grapevines, then relating these data to GWSS densities on treated trees and grapevines relative to untreated ones, we have demonstrated the capacity of a single imidacloprid treatment per season to reduce GWSS populations. Questions that initially arose following the first large-scale applications in Temecula in Spring, 2000 concerning the quantity, distribution, and persistence of imidacloprid in citrus trees have now been addressed with the results from our studies. Information that will derive from this project should help optimize future GWSS control efforts.

OBJECTIVES

1. Evaluate the titer 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 titers 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 AND CONCLUSIONS

Imidacloprid was applied to Valencia oranges in Riverside through an irrigation system equipped with microjet emitters at 32 oz. per acre on April 10 and April 4, 2001 and 2002, respectively. Xylem samples were collected every two weeks thereafter with a pressure bomb device and analyzed for imidacloprid concentrations using a commercial ELISA detection kit (Envirologix, ME). Consistently higher titers were observed in 2002 compared to the previous year (Figure 1). By 16 May 2002, the mean titer had increased to above 20 ppb, then remained above 15 ppb until 25 July before declining. In contrast, mean imidacloprid titers in 2001 never exceeded 15 ppb, but remained between 10-15 ppb from 07 June through 20 July (Figure 1). Within-tree distributions of imidacloprid varied insignificantly among the four quadrants and two elevations from which xylem samples were collected (Figure 2). The near-uniform distribution of imidacloprid to all parts of the mature orange trees had a severe impact on GWSS nymphs and adults (Figure 3). Weekly samples collected from treated and untreated trees revealed a sharp decline in nymphal densities approximately 6 weeks post-treatment that persisted through the end of the nymph developmental season. The emergence of adults in late June and early July coupled with a frenzy of flight activity tended to mask any differences between treated and untreated trees save for the large numbers of dead adults that were observed beneath treated trees. By late July, however, adult densities decreased on treated trees and remained significantly lower than untreated trees through the remainder of the year (Figure 3).

Figure 1. Temporal pattern of imidacloprid titers in Valencia orange trees during 2001 and 2002. Each sampling date gives a scatter of points representing titers of individual trees with the range of imidacloprid titers identified by the vertical lines. The mean titer for each date is defined by the intersection of the traversing line with each vertical line.

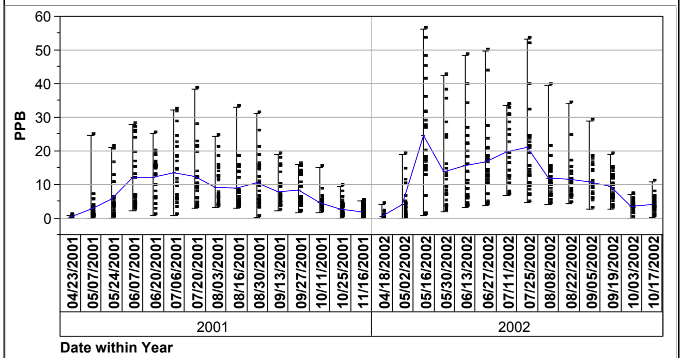


Figure 2. Within-tree distributions of imidacloprid in Valencia oranges according to height (a) or directional location (b). (Explanatory details for this figure are the same as Figure 1).

a)

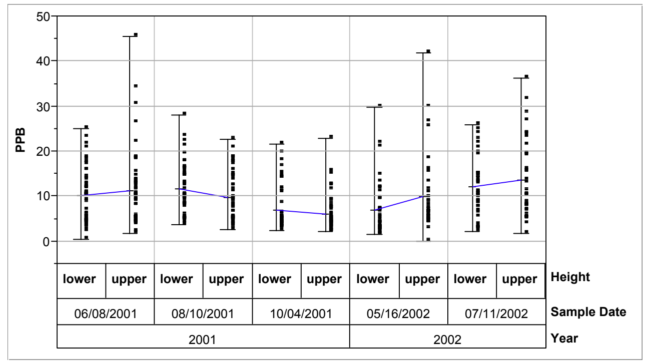
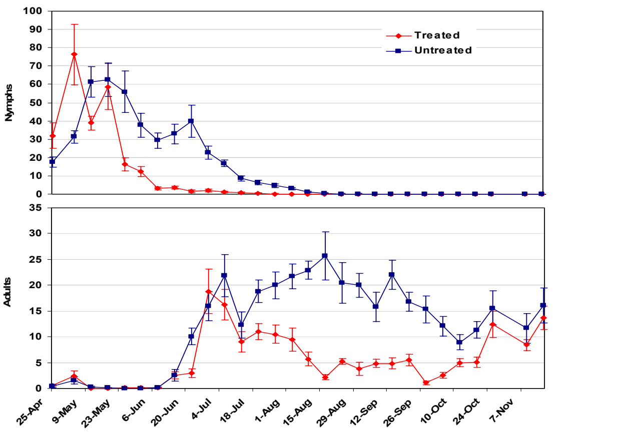


Figure 3. Comparison of GWSS nymphal (top) and adult (bottom) densities on imidacloprid-treated and untreated Valencia oranges.



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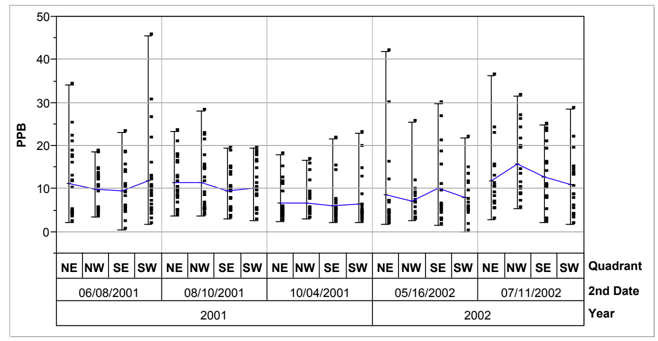


Figure 4. an (±SEM) titers of imidacloprid in Cabernet grapevines in Temecula treated with either 16 oz/16 oz (01 May and 26 July) or 32 oz on 01 May 2002. Note the higher titers in grapes compared to oranges as well as the difference between 16 oz and 32 oz rates.

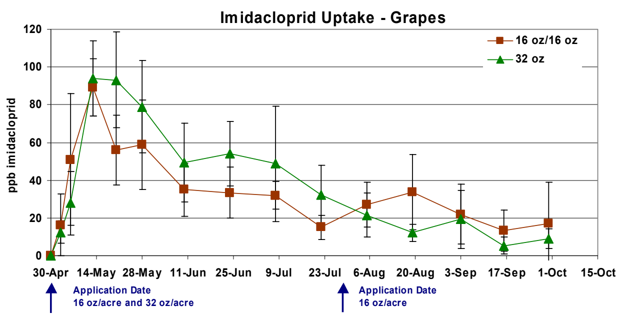
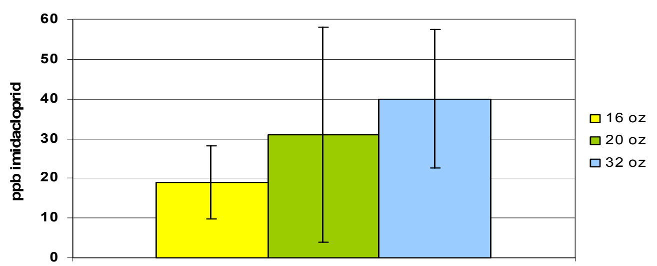


Figure 5. Imidacloprid titers in 1-year-old grapevines treated at 3 rates and measured 8 weeks post-application.



The uptake and distribution of imidacloprid applied to grapevines at 16, 20, and 32 oz/acre were assessed for Cabernet Sauvignon (Figure 4) and Syrah (Figure 5) varieties in Temecula vineyards from 01 May until 31 October 2002. Uptake into vines was rapid, reaching levels above 100 ppb within 10 days. This is in contrast to the uptake dynamics in citrus where maximum levels were only reached at about 6 weeks post-treatment. In particular, the persistence of imidacloprid in trees and vines treated with the 32oz/acre rate was impressive, and gave a clear indication as to why this insecticide has proven to be so successful in area-wide management programs.

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