

# LABORATORY AND FIELD EVALUATIONS OF IMIDACLOPRID (ADMIRE), THIAMETHOXAM (PLATINUM), AND ACETAMIPRID (ASSAIL) AGAINST THE GLASSY-WINGED SHARPSHOOTER

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**Reporting Period:** The results reported here are from work conducted from October 2003 to October 2004.

## ABSTRACT

Admire and Platinum applications were compared in Temecula vineyards. Although the uptake and residual persistence of both products was excellent, peak levels of Platinum within the xylem fluid of vines were almost 10-fold higher than Admire levels despite a lower application rate. In studies conducted in vineyards in the Coachella Valley, Admire uptake was considerably less efficient than that measured in Temecula vineyards. This could be rationalized by differences in soil properties between the two regions and the impact of irrigation practices. In soil column studies, Admire was shown to be more mobile in Coachella soils. Uptake was improved in vines that were under a strict irrigation regime that delivered water according to recommended vine requirements. Under these conditions, Admire within the xylem fluid attained recommended levels for GWSS suppression. In a preliminary evaluation of foliar applications of Assail, residues of acetamiprid, the active ingredient of this insecticide, were detected within the xylem fluid. Therefore, foliar applications may prove effective against GWSS both through contact and systemic activity.

## INTRODUCTION

In this report, we include data on the uptake and distribution of imidacloprid within grapevines in Temecula and Coachella Valley regions, focusing on the impact of soil type and irrigation on its rate of uptake and persistence within the plant over time. We also include laboratory-derived data from soil column studies, which demonstrate the impact of soil type on insecticide movement in soils from both regions. And, we evaluated two additional chemicals from the neonicotinoid insecticide class to determine their likely behavior under conditions in California vineyards.

## OBJECTIVES

1. Determine the impact of soil type and irrigation on the uptake and residual persistence of imidacloprid and thiamethoxam;
2. Determine the best combination of application rates and number of applications of imidacloprid and thiamethoxam in order to maximize and extend protection to vineyards;
3. Determine the absorption, distribution and residual persistence of foliar applications of acetamiprid within grapevines.

## RESULTS

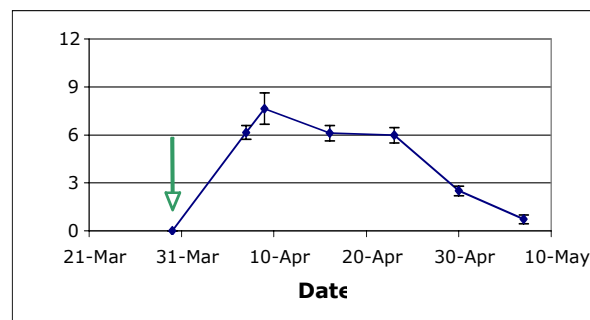
**Objective 1.** Determine the impact of soil type and irrigation on the uptake and residual persistence of imidacloprid and thiamethoxam.

### *Admire Applications in Coachella Valley Vineyards*

During the 2004 season, we continued to monitor the levels of imidacloprid in the xylem fluid of table grapevines treated with 16 fl oz/ acre in several vineyards in Coachella Valley. As in 2003, the peak titers of imidacloprid within the xylem sap of Coachella grapevines were extremely low and the overall persistence of the material was short-lived (Figure 1). In each of the vineyards tested, a single application of 16 fl oz/acre of Admire resulted in xylem fluid levels of imidacloprid of no more than 8 ppb, which is very close to the critical level required for protection against sharpshooter feeding.

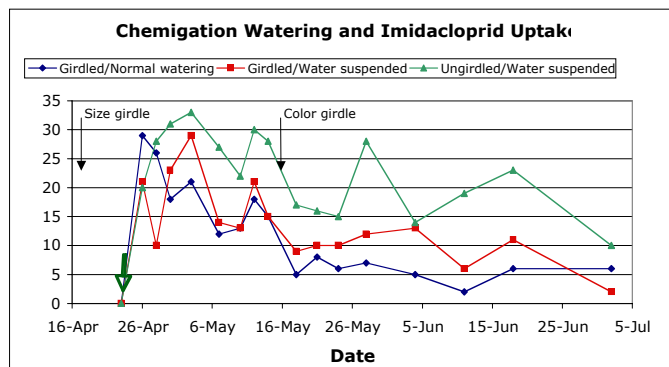
### *Impact of Irrigation and Girdling on Admire Uptake*

Over-watering is a potential problem for the effective use of Admire in Coachella vineyards, given the sandy soils. With this in



**Figure 1.** Uptake of Admire in a Coachella vineyard. The green arrow indicates the date of application of 16 fl oz/acre Admire. Each point is the mean  $\pm$  SEM of 24 vines

mind, we conducted an additional study in a vineyard where timing of irrigation to a Flame Seedless crop is determined from the crop coefficient. In addition to studying the effects of irrigation at the time of application, we also availed of the opportunity to study the impact of girdling on uptake into vines that were either size-girdled or not. We also examined the effect of withholding water from vines for two days subsequent to the application to test whether the Admire would ‘stick’ to the soil more effectively once it had been administered to the soil.

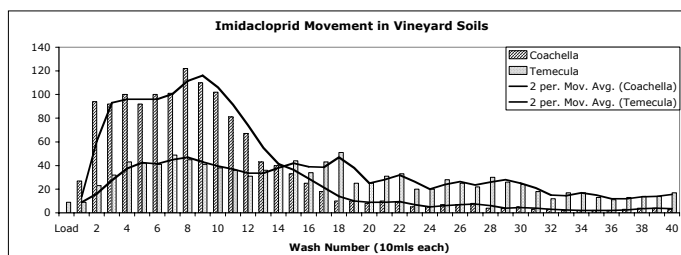


**Figure 2.** Uptake of Admire into girdled and ungirdled Flame Seedless grapevines. The green arrow indicates the Admire application date (16 fl oz/acre). Vines were either girdled (blue and red lines) or ungirdled (green line) for size. All vines were girdled for color on the same date. Water was suspended for two days after the Admire application in the red and green series.

therefore, that girdling can affect the efficiency of uptake. We intend to conduct further studies on the impact of girdling and irrigation on uptake during the 2005 season. One aspect of our work will be to try and define conditions for optimum uptake of Admire before the growers girdle their vines.

### Soil Column Studies

Laboratory-based soil column studies confirmed that the different soil properties in these areas could account for the differences in uptake (Figure 3). In these studies, the movement of imidacloprid through the Coachella soil column was more rapid, whereas the movement through the Temecula soil column was slower. This illustrates the impact that soil-type can have on insecticide availability. Under similar watering conditions, Admire is bound more tightly to the clay soil of the Temecula vineyard, compared with the sandier soils of the Coachella vineyard. If this mimics conditions in the field, then Admire will remain available for uptake into Temecula vines for a longer period. In reality, there are considerable differences between the two regions in the amounts of water used during irrigation. In Coachella Valley, where vast amounts of water are applied daily to each vine, it is possible that Admire is washed past the root zone before significant uptake can occur. In contrast, soils in Temecula vineyards can bind Admire more effectively, and with typically lower water volumes used during irrigation, more effective uptake of Admire is achieved.



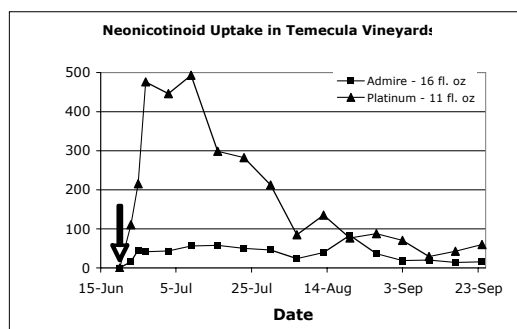
**Figure 3.** Movement of imidacloprid through soil columns. Soil was collected from Temecula and Coachella vineyards where we conduct our uptake trials. The greater mobility of imidacloprid in Coachella soil is indicated by the more rapid recovery of imidacloprid.

**Objective 2.** Determine the best combination of application rates and number of applications of imidacloprid and thiamethoxam in order to maximize and extend protection to vineyards.

### Admire and Platinum Applications in Temecula Valley Vineyards

In this component of the study, conducted in a Temecula Valley vineyard during 2003, we compared application rates of 16 fl oz/acre Admire and 11 fl oz/acre Platinum applied by drip chemigation (Figure 4). The titers of imidacloprid measured within the xylem fluid of vines treated with 16 fl oz/acre Admire were comparable with those measured in our previous trials conducted in Temecula vineyards (Toscano et al., 2003). This result establishes the consistent nature of Admire applications at this rate and hence the value of this product for GWSS management in vineyards. Despite using a lower Platinum application rate, peak titers of thiamethoxam within the xylem fluid exceeded those of imidacloprid by over 10-fold. And throughout the season, thiamethoxam levels were consistently higher than imidacloprid levels.

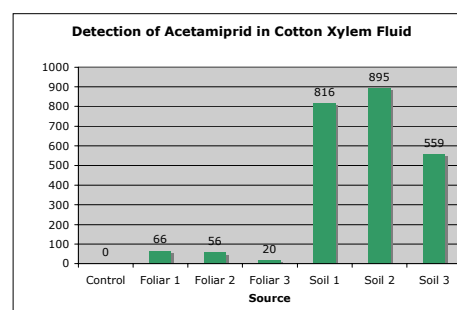
**Objective 3. Determine the Absorption, Distribution and Residual Persistence of Foliar Applications of Acetamiprid within Grapevines.**



**Figure 4.** Comparison of uptake profiles for Admire and Platinum applied at 16 fl oz and 11 fl oz/acre, respectively.

Acetamiprid is a third neonicotinoid of interest to growers and is recommended for foliar application to vines. It is reported to have systemic activity arising from translaminar movement of the chemical following application, as this will then be a more effective toxicant against the GWSS. Our studies were designed to determine the extent of the systemic activity of this material (applied as Assail). It is important to evaluate this aspect of acetamiprid behavior on grapes because it will determine the longevity of the product as a control measure for GWSS and PD transmission. The material will be short-lived if it does not penetrate into the plant, whereas translaminar movement is likely to enhance its efficacy by allowing for a more uniform distribution throughout the feeding zones of the GWSS. This could be important given the extremely low rates of application currently recommended for grapes, and could also compensate for less than complete coverage of the plant surface during application.

Assail was applied to the leaves of cotton plants by dipping individual leaves in insecticide solution. We avoided any contact between insecticide and the leaf petioles and main stem of the plants. After two weeks, the leaves were removed from the plant and the xylem fluid present in the main stem extracted and tested for the presence of acetamiprid using an ELISA detection method. We also treated plants by applying Assail to the soil, and the titers of acetamiprid present in the xylem of these plants was tested at two weeks post-treatment. Not surprisingly, we detected acetamiprid in the soil-treated plants (Figure 5). However, we also detected acetamiprid within the xylem of foliarly-treated plants, although the concentrations were considerably lower than in the soil-treated system. Nevertheless, our results indicate that the material had penetrated the leaf tissues and moved to the main stem where GWSS were most likely to feed. We are continuing with this approach using potted grapevines and citrus trees.



**Figure 5.** Acetamiprid levels in the xylem fluid of cotton treated foliarly (3 plants) and through the soil (3 plants) with Assail. Each bar represents the levels of insecticide measured in an individual plant.

## CONCLUSIONS

Our studies continue to provide growers with a better understanding of the behavior of Admire within vineyards in the southern California area. Certainly, there are significant differences between the Temecula and Coachella Valley vineyards and we are investigating the possible causes of these anomalies in our remaining study objectives. It seems clear for Temecula growers that a single application of 16 fl oz/acre can provide up to three months of protection from GWSS. An early season application of 16 oz/acre, followed by a later application at the same rate, would appear to be the most attractive option for achieving effective xylem sap levels of imidacloprid for protection against sharpshooters. GWSS are known to feed on vines throughout the year, including during the winter dormant phase, so by using the two-16 oz application strategy growers would be able to extend the window of protection well beyond that afforded to them with a single application of 32 oz/acre.

The titers of imidacloprid within the xylem fluid of vines in Coachella Valley vineyards treated at 16 oz/acre continue to be of concern. For two years now, we have monitored the effectiveness of the 16 fl oz rate and have found that most growers in this region are not receiving the same levels of protection for their vines as Temecula growers using the same rate. Our most recent study has shown the likely impact of watering on insecticide availability within the sandy soils of Coachella. If over-watering occurs it will compromise the effectiveness of Admire applications.

The results for uptake of imidacloprid and thiamethoxam are interesting. The uptake of imidacloprid is steady throughout the season, which should provide sustained protection to vines. In contrast, there is a rapid spike in thiamethoxam levels that takes concentrations to over 10-fold greater than imidacloprid. Further work is needed to determine suitable rates if this product is to be considered for use in vineyards.

**REFERENCES**

Toscano, N., Byrne, F., Castle, S., Bi J., Prabhaker, N., Learned, M., and C. Gispert. 2003. Laboratory and field evaluations of imidacloprid, thiamethoxam and acetamiprid against the glassy-winged sharpshooter on grapevines. Proceedings of the Pierce's Disease Research Symposium pp 315-317, Coronado Island Marriott Resort, San Diego, California. Dec 8-11, 2003.

**FUNDING AGENCIES**

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