LABORATORY AND FIELD EVALUATIONS OF NEONICOTINOID INSECTICIDES AGAINST THE GLASSY-WINGED SHARPSHOOTER

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Reporting Period: The results reported here are from work conducted July 2007 to September 2007.

ABSTRACT

The uptake of dinotefuran (applied as Venom 70SG) and imidacloprid (applied as Admire Pro) was compared in vineyards located in Napa Valley, Temecula Valley, and Coachella Valley. Our study clearly showed the interaction between the insecticide chemistry and the local soil and climatic conditions. In Napa, imidacloprid uptake was poor. Better uptake of the more soluble product dinotefuran was achieved, and this may provide growers in that region with an effective pest management tool for the protection of their vines against Pierce's disease (PD) vectors. In terms of the concentration of active ingredient in the xylem fluid, dinotefuran uptake was also superior in Coachella and Temecula vineyards. However, imidacloprid remains an excellent chemical for the protection of Temecula vines against glassy-winged sharpshooter (GWSS) and PD.

INTRODUCTION

Neonicotinoid insecticides play a major role in the management of the glassy-winged sharpshooter. The focus of this project has been to identify the factors that influence the successful deployment of these insecticides within different cropping systems affected by the GWSS. Soil type and irrigation play a major role, and their effects vary depending on the chemical properties and water solubility of the insecticides, as well as agronomic practices used in the production of table and wine grapes. In this project, we are studying the uptake and persistence of the neonicotinoids imidacloprid (Admire Pro) and dinotefuran (Venom) in three viticulture regions of California – Coachella Valley (table grapes), South Coast (wine grapes at Temecula Valley) and North Coast (wine grapes at Napa Valley) regions. These regions represent the extremes in terms of climate, soil type and irrigation practices, and are therefore good study sites for comparing the efficacy of the two most important neonicotinoids used for sharpshooter management. In terms of water solubility, imidacloprid and dinotefuran represent the two extremes within the neonicotinoid insecticide class. Dinotefuran has 80-fold greater solubility in water than imidacloprid, and this may make it a more viable option for North Coast growers looking for an effective soil-applied neonicotinoid insecticide under reduced irrigation. In contrast, imidacloprid may be the preferred product in Coachella where excessive use of irrigation water may compromise the use of highly soluble chemicals in favor of less soluble products.

OBJECTIVES

1. Determine regional differences in the uptake and persistence of imidacloprid and dinotefuran in grapevines in order to maximize protection of vineyards.
2. Evaluate generic formulations of imidacloprid in grapevines.
3. Develop an ELISA for the detection and quantification of dinotefuran residues within plant tissues.

RESULTS

Trials to evaluate the uptake of imidacloprid and dinotefuran in vineyards located in three viticulture regions of California have been completed (Figure 1). In Coachella and Temecula Valley vineyards, two rates of Venom were evaluated – the full label rate (6 oz/acre) and half the label rate (3 oz/acre) - and the half label rate of Admire Pro. We used the half label rate of Admire Pro (7 fl oz/acre) because this rate achieved the desired 10 ppb threshold concentration in the xylem necessary to kill a sharpshooter (Byrne and Toscano, 2006). In Napa, we examined the same rates of Venom used in Coachella and Temecula, but used the full label rate of Admire Pro. In an earlier study, both the half and full label rates resulted in poor uptake (Weber et al., 2005), so we chose the maximum rate for this study.

The uptake of imidacloprid in at the Napa vineyard was poor, corroborating our earlier findings (Weber et al., 2005). Of the 144 samples taken, only one vine recorded a value above the 10 ppb threshold. Most vines were below the detection limit of

the ELISA (4 ppb). The uptake of imidacloprid in Coachella and Temecula was better, although levels were consistently better in Temecula. Levels in Coachella were marginally lower then the recommended threshold throughout most of the assessment. While we expected better concentrations, it is likely that the irrigation regime at this vineyard was not conducive to providing the desired levels of uptake. In Temecula, imidacloprid moved into vines quickly. There was a period, however, when levels dropped below the required threshold. This dip in concentration occurred when irrigation water was reduced. During the period when weekly irrigation was practiced, the uptake rose well above the threshold levels and the vines were well protected from PD.

Dinotefuran was detected in vines at each vineyard location, and the concentrations in the xylem were highest in vines treated at the full label rate. In Napa, dinotefuran levels rose quickly, suggesting that the uptake occurred at the time the treatments were made (the only time water was used in this vineyard). The rate of uptake in Coachella and Temecula was also rapid but more sustained, again suggesting the influence of the irrigation at these sites. In Temecula, the dip associated with imidacloprid uptake was evident at the lower rate of dinotefuran, but not at the high rate.

The effect of the greater solubility of dinotefuran compared with imidacloprid is reflected in the higher levels of dinotefuran at the three sites. But this also results in a more rapid decline.

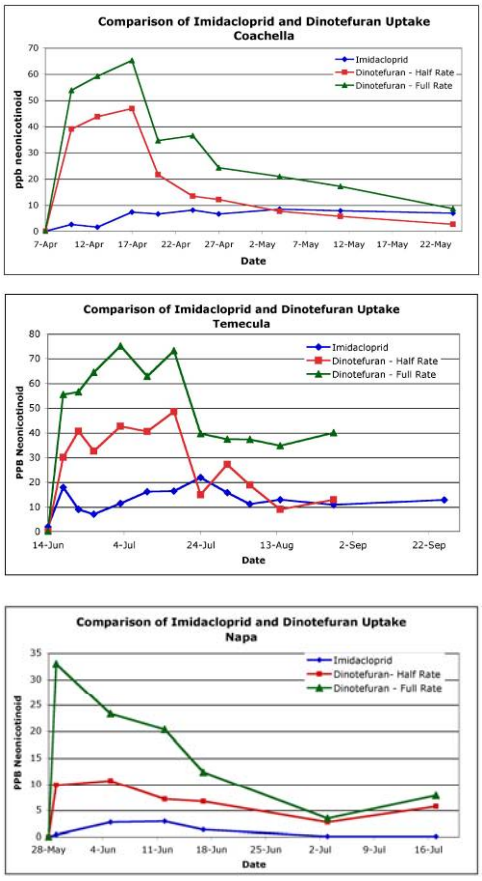

Figure 1. Uptake of imidacloprid and dinotefuran in vines at three vineyard locations in California. Dinotefuran was applied as Venom 70SG and imidacloprid was applied as Admire Pro. The full rate of Venom was 6 oz/acre. Both full and half label rates were compared at each location. Imidacloprid was applied at half label rate in Coachella and Temecula, while the full label rate was used at the Napa vineyard. The final dinotefuran sample set for Temecula has yet to be analyzed. Each point on the graphs represents the mean for at least 12 vines.

CONCLUSIONS

Dinotefuran proved better than imidacloprid in terms of uptake in the Napa vineyard. In this region, imidacloprid uptake is compromised by the heavy clay soils (which bind the insecticide tightly, making it unavailable for uptake through the roots) and the lack of irrigation (a consequence of the local climatic conditions). Although we observed rapid uptake at the full label rate of Venom, the concentrations began to decline after the first week. The spike in uptake occurred at the time of the application and suggests that irrigation at the time of the application will need to be carefully controlled if optimal delivery of the product is to be achieved.

It is clear from our data that the uptake of dinotefuran is superior to that of imidacloprid at all sites. But the question remains whether the levels attained are actually high enough to provide effective pest management. This is an area of research that will need to be investigated.

Imidacloprid remains the neonicotinoid of choice for Temecula vineyards. The uptake at half the label rate provides good protection to vines, both in terms of rapid uptake and persistence during the growing season. In vineyards with a heavier soil, growers might be advised to use a higher rate of application, particularly if there are periods when irrigation water is withheld. At these times, the imidacloprid is likely to bind to the clay particles, making it more difficult for uptake to occur in the reduced water environment around the roots.

REFERENCES

Byrne, F.J., Toscano, N.C., 2006. Uptake and persistence of imidacloprid in grapevines treated by chemigation. Crop Protection 25: 831-834

Castle, S.J., Byrne, F.J., Bi, J.L., Toscano, N.C., 2005. Spatial and temporal distribution of imidacloprid and thiamethoxam in citrus and impact on *Homalodisca coagulata* Wells populations. Pest Manag. Sci. 61, 75-84.

Weber, E.A., Byrne, F.J., Toscano, N.C., 2005. Optimization of Admire applications in north coast vineyards. In Proceedings of the Pierce's Disease Research Symposium, pp 395-398, San Diego Marriott Hotel and Marina, San Diego, California, Dec 5-7, 2005.

FUNDING AGENCIES

Funding for this project was provided by the University of California Pierce's Disease Grant Program.