OPTIMIZATION OF ADMIRE APPLICATIONS IN NORTH COAST VINEYARDS

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ABSTRACT
Xylem fluid samples from commercial vineyards treated with Admire were collected and analyzed for imidacloprid content in July 2005. Additionally, vines that had been treated with Admire at differential rates in a 2004 study were re-evaluated in 2005. Imidacloprid was not detected in most samples collected in 2005 and was usually at low levels when detected. These results corroborate our results from 2004 that indicate that the use of Admire in North Coast vineyards may have limited effectiveness compared to its use in other regions in California. Limiting irrigation in order to manage vine growth and berry size for premium wine production may prevent the effective use of Admire in some growing regions for control of sharpshooters.

INTRODUCTION
Admire insecticide (Bayer CropSciences) is widely used in grapes and citrus for control of the glassy-winged sharpshooter (GWSS) and to limit the spread of Pierce's disease (PD). It is a soil-applied product that delivers the active ingredient imidacloprid, a neonicotinoid insecticide that has been shown to be very effective against GWSS and other sucking insects (1). In Northern California, Admire is sometimes used against populations of blue-green sharpshooters, the most common vector of PD in this region, as well as to treat for other pests.

Admire is applied to vineyards through a drip system. It is recommended that it be applied to moist soils in order to enhance its downward movement into the root zone and its uptake into vines. Most research on uptake and persistence of imidacloprid in grapevines has been done in Southern California in warm regions on sandy or loam soils where vines are irrigated at relatively high rates (2,3,4). In the heavier soils and cooler climates common in North Coast vineyards, there are questions about the best application strategy for Admire in order to ensure effective levels of imidacloprid in grapevines.

In 2004, we conducted a trial (5) to investigate different application regimes of Admire in a Napa County vineyard. The vineyard is located in a cool region (Carneros), is planted on a loam soil with 15% clay content and had minimal irrigation during the 2004 growing season. In 2005, we re-tested vines in this trial to see if there was any further uptake of Admire a year after the applications were made. In addition, we sampled ten other vineyards to test for imidacloprid levels following grower-applied treatments of Admire.

OBJECTIVE
Evaluate the uptake and sustained concentrations of imidacloprid in grapevines planted on clay loam soils in a cool region (Carneros) following different application regimes of Admire insecticide.

RESULTS
Admire treatments in the 2004 study were as follows:

- T1: 32 oz (full rate) in March
- T2: 16 oz in March / 16 oz in May
- T3: 32 oz in May
- T4: 16 oz in May / 16 oz in July

There were three replications of each treatment. Each replicate included three vine rows and extended the length of the vineyard block (136 vines). There was an untreated buffer row between each replicate. The vineyard was irrigated prior to each Admire application to ensure moist soil conditions, and water was applied for several hours after the injections were completed to move the material into the root zone. Other than the irrigations made in conjunction with our treatment applications, only 5 gallons per vine of additional irrigation was applied prior to harvest.

Xylem fluid samples were collected one week after the initial applications and continued every two weeks through September 2004. At each sampling, 200-500 microliters of xylem fluid were extracted from each of eight vines within every replicate, and were kept separate. A different set of vines were sampled each week. Fluid extractions were made using a pressure bomb equipped with a large chamber that could accommodate shoots up to 18 inches in length. Samples were frozen on dry ice in the field and subsequently held in a freezer. Samples were shipped frozen overnight to UC Riverside and analyzed using a commercial ELISA detection kit (EnviroLogix, ME) (2).

Figure 1 summarizes the results of the 2004 study. None of the treatments resulted in effective uptake of imidacloprid as measured by our analysis. Average imidacloprid concentrations (N=24) for each treatment on each sampling date ranged from 0 to 3.71 ppb. 74% of the average values were less that 1 ppb. Ten ppb is considered to be a minimum threshold level for protection against sharpshooter feeding (3).

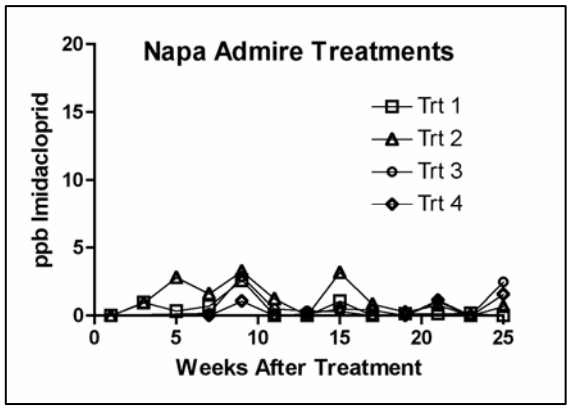

Figure 1. Imidacloprid levels in grape xylem fluid following treatment with Admire. Each point is the mean of 24 vines.

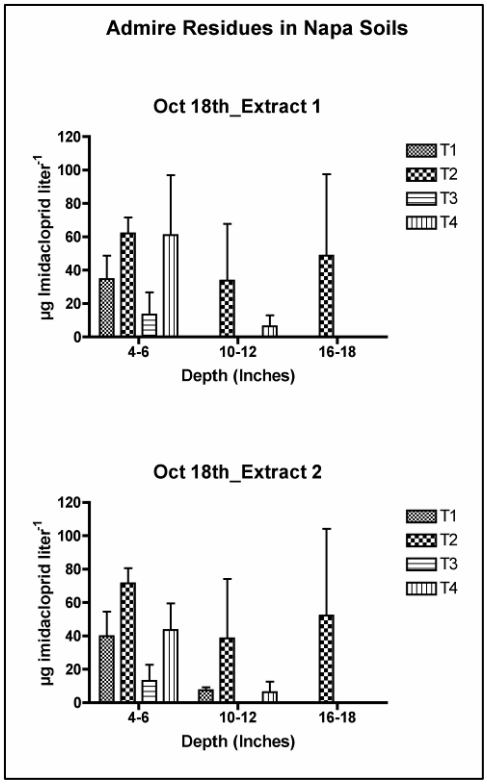

Figure 2. Imidacloprid levels in water washes of Napa soil samples. Each bar is the mean ± SEM of 3 samples.

In consideration of these poor uptake results, we collected soil samples in October 2004 to determine if imidacloprid was bound in the soil. Soil samples were collected from three depths below a drip emitter at one vine in each of the twelve replications in the trial. Sample depths were 4-6 inches, 10-12 inches and 16-18 inches.

From each of these 36 samples, 20g of soil was washed in water for one hour and then centrifuged. A diluted sample of the supernatant was evaluated for imidacloprid by ELISA. These procedures were repeated to generate two extractions per soil sample. The results are shown in Figure 2. Imidacloprid was detected at the 4-6 inch level in all treatments. However, at the 16-18 inch depth it was found in only one of the treatments.

Because these results indicated that there was still considerable imidacloprid in the upper soil profile in October 2004, we decided to re-test vines in 2005 to see if there was any improved uptake following winter rains. A nearby Carneros weather station (California Irrigation Management Information System station 109) recorded 22.29 inches of rain from October 2004 to May 2005.

In May 2005, two vines from each replicate were sampled and xylem fluid was tested as previously described. These samples all tested negative for imidacloprid.

In addition to re-testing vines from the 2004 trial, in June 2005 we sampled vines in several Napa County vineyards that had a history of Admire applications to see if we could detect better uptake compared to our Carneros trial site.

We collected 116 xylem fluid samples from ten vineyards: eight in Napa County and two in Sonoma County. The vineyards were all planted on loam to clay loam soils typical of the region. Samples were immediately frozen on dry ice and later analyzed for imidacloprid content as previously described. Results are summarized in Table 1.

Table 1: Imidacloprid levels in June 2005 samples from vineyards treated with Admire.

Vineyard	Admire history*	# vines tested	# vines in imidacloprid ranges			
			0	1-6 ppb	7-10 ppb	> 10 ppb
Napa 1	a/b	12	9	3	0	0
Napa 2	b	18	8	7	2	1
Napa 3	c	18	13	3	1	1
Napa 4	b	24	22	2	0	0
Napa 5	b	12	4	8	0	0
Napa 6	c	8	6	2	0	0
Sonoma 1	d	16	13	3	0	0
Sonoma 2	e	8	7	1	0	0
All sites		**116**	**82**	**29**	**3**	**2**

* a – 16 oz Admire March 2004 & 2005
b – 16 oz Admire March 2003, 2004 & 2005
c – 32 oz Admire March 2004 & 2005
d – 16 oz Admire Oct. 2004 and March 2005
e – 16 oz Admire June 2005

The results from this survey of vineyards indicated poor uptake of imidacloprid at all of the sites. Imidacloprid was not detected in 71% of the samples. Only 2 samples had levels above the 10 ppb threshold considered necessary for effective control of sharpshooters.

Soil column studies (4) showed that imidacloprid was bound more strongly to the Napa soils as compared to soils from Temecula or Coachella (Figure 3). Combined with the low irrigation rates typically applied to most North Coast vineyards (0-0.5 acre-feet per season), achieving effective levels of imidacloprid in vines via Admire applications to the soil will be difficult.

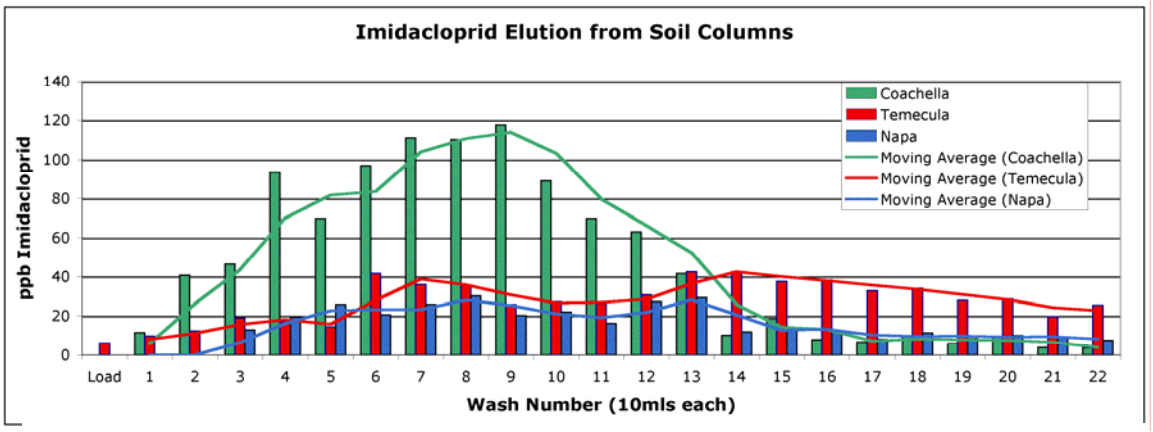

Figure 3. Elution of imidacloprid from soil columns prepared from Coachella, Temecula and Napa vineyard soils. Equal quantities of imidacloprid were loaded (in 10ml) onto the columns, which were then washed with successive 10ml volumes of water. As each 10ml wash was added to the top of the column, 10mls (the eluate) was displaced at the bottom. The imidacloprid content in each eluate was quantified by ELISA. The graph shows a typical elution profile for the soil types found in these vineyards.

CONCLUSIONS

The use of Admire in North Coast vineyards is unlikely to provide the same levels of control of sharpshooters as experienced in Southern California. Uptake of imidacloprid in this region appears to be limited both by the nature of the soils, as well as the climatic conditions and prevailing viticultural practices that limit the amount of water applied to the vines during the growing season.

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