Dislodgeable Foliar Residues Following Reduced-Volume and Conventional Myclobutanil Application on Grapes

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Summary

Reduced-volume, high concentration sprays use smaller droplets than high-volume systems and may improve pest control efficacy. They may also produce higher dislodgeable residues and potentially increase worker exposure to pesticides. To examine these potential increases, myclobutanil fungicide was applied in 1996 and 1997 onto five commercial wine vineyard sites using conventional, high-volume (80 - 100 gal/acre), and air-assisted, electrostatic, reduced-volume (8 - 10 gal/acre) spraying systems. The conventional application was made at full rate (4 ounces/acre) whereas the electrostatic application was made at half rate (2 ounces/acre) and full rate (4 ounces/acre). The study evaluated initial deposition and foliar residue dissipation. Dislodgeable foliar residue (DFR) was monitored in two vine locations: inside the canopy around the clusters, and outside the perimeter of the canopy. DFR was removed by aqueous surface extraction and analyzed by gas chromatography and high performance liquid chromatography. When results were averaged for inside and outside the canopy and for all sites, they showed that the air-assisted, electrostatic, reduced-volume full rate (EFR) resulted in the highest foliar deposition, followed by the conventional, high-volume full rate (CFR). CFR attained 68% of the EFR deposition. The electrostatic, reduced-volume half rate (EHR) gave the lowest foliar deposition and was equivalent to half the EFR deposition. It also achieved approximately 70% of the deposition obtained with CFR. Initial deposition outside the canopy with EFR was twice the deposition obtained with CFR and EHR. Inside the canopy, both EFR and CFR gave similar deposition, and EHR was half of the EFR and CFR deposition. Nevertheless, statistical results were not significantly different. Pesticide deposition is also affected by canopy density such that pesticide deposition resulted in approximately half the amount that for a site with a canopy density twice the size of another vineyard. The application method had no effect on pesticide dissipation rate. However, canopy location had a significant effect, indicating shorter decay on the outside grape foliage, and slow pesticide degradation inside the canopy.

Introduction

Commercial production of grapes often involves frequent pesticide applications and continuous worker reentry for cultural practices and harvesting. The high crop value and susceptibility to pest damage require highly effective pesticide application. The prophylactic and routine applications of fungicide, acaricide and insecticide are very common during the production season. The first sulfur application to protect vines against powdery mildew begins soon after budbreak. Growers determine subsequent spray or dusting intervals based on the material used, weather, and their experience. Myclobutanil is one of several commonly used fungicides for control of powdery mildew in commercial grape production. Myclobutanil is a systemic, protectant and curative fungicide. It is generally applied at 18-day intervals, and application intervals rarely exceed 21 days. Treatment begins at pre-bloom when shoots reach 12 to 18 inches, and continue throughout the fruit production season. Currently, the restricted entry interval for myclobutanil-treated fields is 24 hours with a preharvest interval of 14 days.

In recent years there has been a change in the volume rates and methods of spray atomization used for spraying vineyards and orchards in California. The bulk of commercial vineyards are still sprayed with conventional medium volume rates, but an increasing portion is sprayed at very low volume rates. Although these reduced-volume spraying methods are practiced in California, there is little published data reporting pesticide deposition on the leaf surface in different areas of the grape canopy.

Current projects are being developed to improve spray application equipment (Planas *et al.*, 1997). In connection with the development of new equipment, there is also considerable discussion about reducing pesticide dose rate and better methods of calibration (Furness and Magarey, 2000). Electrostatic spraying was developed to obtain more efficient applications of pesticides. With electrostatic spraying, the pesticide solution passes through specially designed spray nozzles containing electrodes and takes on a high electrical charge. Plants are electrically neutral since they are inherently grounded by being rooted in the earth. As the negatively charged spray cloud approaches the plant, it causes the plant to take on the opposite or positive charge. At the same time, the negatively charged drops in the cloud repel each other so that the cloud expands outward and is drawn to all surfaces of the positively charged plant. This results in an increased deposition with uniform coverage on all plant surfaces versus uncharged sprays (Splinter, 1968). Reaching the target enables less material to perform better and eliminates wasteful run-off (Matthews, 1989).

Pesticide application is generally regarded as extremely inefficient, and numerous researchers have estimated that only 1-2% of the original mixture arrive at the target site of action (Hall, 1985). Thus, about 99% moves into the ecosystem to potentially contaminate the land, water, and air (Pimentel and Levitan, 1986). Many pesticide labels were written for conventional hydraulic application equipment that uses a high volume of diluent to achieve coverage of the target. Measurements carried out in apple orchards with different sprayer models show that from 15 to 50% of the total sprayer output is lost out of the target zone and it is likely to be carried away by the wind (drift) or to be deposited on the ground (Filiat *et al.*, 1993). Conventional equipment is less efficient than some reduced-volume application technologies that have been developed (Bode, 1981, Hislop 1987). However, environmental and economical reasons demand that farmers use less chemicals that must be better distributed to maintain their effectiveness. Hislop (1987) reviewed numerous studies of droplet size and concentration that indicated increased pest-control efficacy with decreasing droplet size and increased concentration. Nevertheless, the small droplets (<100 µm diameter) used are susceptible to drift (Elliot and Wilson, 1983; Spillman, 1984; Guye *et al.,* 1991; Salyani, 1997). Reduced-volume and reduced-volume electrostatic spray techniques have shown potential for reduction in pesticide use through improved pesticide deposition and pest control efficacy (Law and Giles, 1980; Bode, 1981; Arnold *et al.*, 1984, Raisigl *et al.*, 1991). Prototypes of electrostatic sprayers based on Dr. Edward Law's patent have shown excellent insect control when one-half the recommended insecticide rate is applied at low spray volume (Law, 1978, 1979).

The efficacy of some plant-applied insecticides may be affected by persistence (Wilson *et al.*, 1983) and by canopy penetration and coverage (Wilce, *et al.*, 1974). The improved efficacy of the more recent pesticides has allowed rates to be reduced to a few grams per hectare. However, the improvement in pesticide deposition (Giles and Blewett, 1991) could similarly increase the potential reentry worker exposure that is closely correlated to dislodgeable foliar residues (DFR). Study results may be used in making regulatory decisions concerning potential worker exposure.

Objective

The objective of this study is to assess the effects of air-assisted, reduced-volume, electrostatic spray technology and air-assisted, high-volume, conventional application on DFR of myclobutanil applied to commercial vineyards. A comparison of a conventional full rate application, and a 50% rate and full rate reduced-volume, electrostatic spray application will be made. Observed data will characterize pesticide deposition and measure decay on grapevine foliage when using both spray technologies.

Materials and Methods

Test Substance: Seven vineyards were treated with myclobutanil, defined chemically as alpha-butyl-alpha-(4-chlorophenyl)-1H-1,2,4-triazole-1-propanenitrile, registered as a Rohm and Haas Company product, Rally™ 40W Fungicide, in 4-ounce water-soluble pouches (EPA Registration No.: 707-215-AA). The compound is toxicity category III material.

Myclobutanil was applied by three treatments comprising different volume rates (Table 1), produced by different nozzles mounted in different positions on the sprayer, as shown in Table 4.

Table 1. Myclobutanil (Rally™ 40W) application on grapevines (1996 – 1997): Sprayer type, rate per acre, and tractor speed during application.

Treatment	Rate (oz/acre)	Rate (oz ai/acre)	Sprayer type	Carrier	Spray volume (gpa)	Application speed* (mph)
EHR	2	0.8	Electrostatic	water	8-10	3-3.8
EFR	4	1.6	Electrostatic	water	8-10	3-3.8
CFR	4	1.6	Conventional	water	80-100	2.5-3.1
Untreated**						

*Set by grower.
**Untreated = eight rows left untreated on site 2 and 5 vines tarped in one row of the conventional 2oz. treatment on sites 3, 4 and 5.
ai = active ingredient.
EHR = Electrostatic Half Rate EFR = Electrostatic Full Rate CFR = Conventional Full Rate

Field Test Design: Two replicates were conducted at a commercial wine grape operation in San Joaquin County, CA, during 1996 (site 1 and 2). In 1997, two sites were selected in San Joaquin County (site 3 and 5), and one in Sacramento County (site 4).

The experimental area consisted of eight and/or nine rows. Vine rows of all the varieties were oriented in an east-west direction. Each site/vineyard was a replicate as indicated on Table 3. Crop characteristics, cultural practices, and treatments are outlined in Tables 1, 2 and 3. Two other sites were treated, but monitoring was discontinued due to rain the day after application.

A one-wire trellis supported bilateral cordon-trained vines on all the sites. Vines were pruned to eight to ten two-bud spurs per cordon (sites 1, 2, 4 & 5), and five to six 2-bud spurs per cordon (site 3). However, during the growing season some 2-bud spurs would have burst a basal bud and formed a third shoot, and even a fourth one at times in the Cabernet sauvignon, thus explaining a denser canopy on this variety. Characteristics of training and support systems are presented in Table 2.

Table 2. Characteristics of training and support systems used for grapevines treated with myclobutanil reduced-volume and conventional application (1996 – 1997).

Site No.	Variety	Spacing (ft)	Age (years)	Trellis	Cross-arm width (inches)	1st wire height (inches)	2nd & 3rd wire height (inches)	Vine height (ft)
1*	Chardonnay	7 X 10	7	T-trellis	18	42	50 - 57	6 - 7
2	Cabernet s.	7 X 10	4	Vertical	0	42	56 - 0	6 - 7
3	Zinfandel	7 X 10	6	T-trellis	24	45	60 - 0	5.5 - 6
4	Cabernet s.	7 X 10	8	Vertical	0	45	54 - 0	6 - 7
5*	Chardonnay	7 X 10	8	T-trellis	18	42	50 - 57	6 - 7

*Same block.
Cabernet s. = Cabernet sauvignon

All the sites were under drip irrigation located on a wire at 15 inches above ground (sites 1, 3, and 5), and 19 inches above the ground (sites 2 and 4). Sites 1, 4 and 5 had a winter cover crop, which was dormant in the summer.

Table 3. Myclobutanil reduced-volume and conventional application on grapes (1996 – 1997): Treatment method, block characteristics and sampling methodology.

Site No.	Sprayer type	No. rows/ treatment	Row length (ft)	No. vines per row	Acres treated	Sampled row No.	Sampled vine on the row	On the row started sampling vine No.
1	Electros	8	1736	248	3.19	3 & 5	Every other	20
	Convent	8	1736	248	3.19	4 & 5	Every other	20
2	Electros	9	1792	256	3.70	4, 5, & 6	Every other	20
	Convent	8	1792	256	3.29	4 & 5	Every other	20
3	Electros	8	875	125	1.60	4 & 6	Every	20
	Convent	8	875	125	1.60	4 & 5	Every	20
4	Electros	8	581	83	1.07	4 & 6	Every	5
	Convent	8	581	83	1.07	4 & 5	Every	5
5	Electros	9	1736	248	3.59	4 & 6	Every other	20
	Convent	8	1736	248	3.19	4 & 5	Every other	20

Electros = Electrostatic
Convent = Conventional

Site 3 was sprayed on May 5th, when shoots were short and the foliage was mainly distributed above the permanent arm, which is at forty-five inches above the ground. For the rest of the sites the shoots were long at the time of application, with many of them bending forward; foliage was nearly equally distributed both above and below the permanent cordon. Application dates corresponded with critical crop stages, grower's scheduled applications for powdery mildew, and laboratory schedule.

Application of the Test Substance: The applications were conducted with typical vineyard ground sprayers, using grower-owned equipment (Table 4). Design and operating details of the equipment were recorded (Table 4).

Myclobutanil was applied alone (no adjuvants or other pesticides). No sulfur was used during the season, once myclobutanil applications began. The test substance was atomized through the nozzles typically used with air-assisted, high volume, conventional vineyard sprayer and reduced-volume, air-assisted, electrostatic applications. The spray was directed to provide thorough coverage of the vines.

Table 4. Spray equipment and corresponding application parameters: Myclobutanil reduced-volume, and conventional application on grapes (1996 – 1997).

Site No.	Sprayer type	Equipment Manufac-turer	Nozzle type	Orifice disc No.	Number of nozzles*	Liquid pressure (psi)	Air pressure (psi)	Gal per acre
1	Electros Convent	Randell Rear's.	ON TARGET** Hollow cone	 D3, D4	20+20 6+6	15 100-110	30	8 80
2	Electros Convent	Gregoire Rear's	ON TARGET** Hollow cone	 D3, D4	20+20+20 6+6	15 100-110	40	10 100
3	Electros Convent	Grower's Rear's	ON TARGET** Hollow cone	 D6	20+20 3+3	15 160-170	35	10 100
4	Electros Convent	Acampo Rear's	ON TARGET** Hollow cone	 D6	20+20 3+3	15 90-100	35	10 100
5	Electros Convent	Gregoire Rear's	ON TARGET** Hollow cone	 D3, 4	20+20+20 5+5	15 100-110	35	10 100

*Number of nozzles per vine side on conventional application, and per vine row on the electrostatic application are separated by (+).
****** ON TARGET™ = product name from the Progressive Grower Technology company (PGT™).
Electros = Electrostatic
Convent = Conventional
Rear's = Rear's Miniblast

Conventional Application: An air-assisted sprayer (Rear's Miniblast, Rear's Manufacturing Company, Eugene, Oregon) that treats one-half of each adjacent row was used for this application type. These sprayers have fans or blowers to produce air currents that carry the spray droplets into the canopies. The air from the blower moves the foliage such that pesticides can be deposited on a large amount of leaf surface (Figure 1). This air blast sprayer was fitted with hydraulic hollow cone nozzles mounted on the air stream. Orientation of each nozzle was typical for a vineyard. The baffles were spaced out evenly, and the nozzles set such that the spray plumes overlapped uniformly.

Fig. 1. Conventional sprayer and canopy density on site 4 (Cabernet sauvignon).

Electrostatic Application: A Randell™ (Randell Equipment Company Inc., Woodlake, California) was used on site 1 and a Gregoire™ air-assisted, over-the-vine, high-pressure sprayer with the "On Target™ nozzle (Progressive Grower Technologies Inc., Canby, Oregon) was used on site 2 and 5 for the electrostatic applications. The Randell™ equipment covered two rows at each pass (Figure 2).

Fig. 2. Electrostatic sprayer – a Randell™ Equipment, over-the-vine, sprayed two rows at a time – site 1 (Chardonnay).

The Gregoire™ equipment covered three rows at each pass (Figure 3). Each nozzle operates independently with each having its own flow control, anti-drip device, indicator lights, and power supply. Both systems had flaps to reduce drift to the next row and increase deposition (Figure 4).

Fig. 3. Electrostatic sprayer – a Gregoire™ Equipment, over-the-vine, sprayed three rows at a time. Notice canopy density - site 5 (Chardonnay).

On site 3, the grower manufactured his electrostatic sprayer with On-Target™ nozzles (Fig. 5). An Acampo (Acampo Machine Works, Lodi, California) electrostatic sprayer with On-Target™ nozzles was used on site 4. Both sprayed 2 rows at each pass. The electrostatic equipment used on sites 3 and 4 had no flaps hanging behind the boxes sustaining the electrostatic nozzles (Figures 5 - 7).

Fig. 4. Electrostatic sprayer, showing boxes with On Target™ nozzle - site 5 (Chardonnay). Notice the sheers to cut canes on the right of the boxes.

Protective boxes guarded the On-Target™ nozzles: two boxes perpendicular to the ground with four nozzles each, and one horizontal box with 2 nozzles, resulting in 20 nozzles per row (Fig. 4 and 7). All the sites had perpendicular boxes mounted at the same height, except site 3 (Fig. 7).

Fig. 5. Electrostatic sprayer, showing boxes with On Target™ nozzles. Sprayed two rows at a time - site 3 (Zinfandel).

Fig. 6. Electrostatic sprayer boxes with On Target™ nozzles. Sprayed two rows at a time - site 4 (Cabernet sauvignon).

Fig. 7. Boxes with On Target™ nozzles. Notice that the boxes running perpendicular to the ground are at different heights from the ground - site 3 (Zinfandel).

Application Parameters: Every site received three treatments (Table 1) in the following order: electrostatic half rate (EHR), electrostatic full rate (EFR) and conventional full rate (CFR). The sprayers operated at the recommended nozzle size, arrangement, application height and distance from the canopy as needed for thorough coverage. The electrostatic application equipment was calibrated according to the manufacturer's operating manual. The pest control operator (PCO) calibrated the conventional equipment. An experienced applicator operated the equipment in a typical manner. The same personnel operated the equipment at site 1, 2 and 5, but different electrostatic equipment was used at site 1. Different personnel operated the equipment at sites 3 and 4.

Plant size and foliage distributions were slightly different, and required different sprayer settings on the conventional sprayer at the different sites (chiefly, the number and/or direction of nozzles), but followed the treatment gallons per acre described in Table 1.

Application parameters and weather conditions are shown on Table 5.

Table 5. Weather conditions and application parameters during reduced-volume and conventional myclobutanil application on grapes (San Joaquin Valley).

Site No.	Date treated	Treat-ment	Actual ground speed (mph)	Application time Start - End	Wind speed (mph)	Predominant wind direction	Cloud cover	Dew
1	7/18/96	EHR	3.08	0603 - 0630	2	SW	Clear	No
		EFR	3.32	0643 - 0710	2	SW	Clear	No
		CFR	3.61	0654 - 0750	2	SW	Clear	No
2	7/30/96	EHR	3.44	0556 - 0615	2	W	Clear	Yes
		EFR	2.76	0635 - 0658	2	W	Clear	Yes
		CFR	N/T	N/T - 0722	2 - 3	W	Clear	Yes
3	5/5/97	EHR	2.94	1000 - 1016	2 - 4	W&SW	Clear	No
		EFR	3.33	1058 - 1112	2 - 4	W&SW	Clear	No
		CFR	3.41	1105 - 1140	2 - 5	SW	Clear	No
4	6/9/97	EHR	3.81	0600 - 0610	2	W&NW	Partly Cl	No
		EFR	3.86	0705 - 0715	2	W&NW	Partly Cl	No
		CFR	3.97	0823 - 0847	2	NW	Partly Cl	No
5	7/8/97	EHR	3.7	0515 - 0537	2	NW	Clear	Yes
		EFR	3.7	0628 - 0645	2	NW	Clear	Yes
		CFR	3.4	0714 - 0814	2	NW	Clear	No

EHR = Electrostatic Half Rate EFR = Electrostatic Full Rate CFR = Conventional Full Rate
N/T = Not taken; Partly Cl = Partly cloudy

Test substance was measured, and added to the delivery system in sufficient quantity to allow for application as well as additional material needed to charge the system. During the mixing and loading the total amount of product, and active ingredient (ai) mixed for each treatment were recorded. Spray mix samples were collected on site 1 and 2 at the start of the treatment both from the tank and nozzles (Appendix 6). The tank sample was a composite from different parts of the tank; an aliquot ranging from 90 – 110 ml for each treatment was submitted to the laboratory. A sample ranging from 3.4 to 5.5 mL was taken from the nozzles for each treatment. These samples were not frozen but chilled immediately for transportation. The CDFA Formulations Laboratory performed chemical analysis by high performance liquid chromatography (HPLC) within 48 hours. The approximate amount of material remaining in the spray system and amount dispersed was determined and compared to the actual area and/or time sprayed to verify that the fungicide was sprayed at +/-10% of intended rate per acre. Nozzles were carefully checked and maintained.

The steps described under application of test substance were monitored and recorded for the rest of the sites (Table 4 and Appendix 1). The actual time spent spraying, direction of the sprayer (Appendix 1), the total length of ground covered during spraying (Table 3), weather conditions, and application parameters (Table 5) were documented.

Dislodgeable Foliar Residue (DFR): DFR pre-application and field quality control background samples were collected before the applications. Post application samples were collected from the three treatments at 1, 3, 7, 14, 21 and 26 days. At some sites, samples were not collected at 21and 26 days after application depending on the grower's reapplication schedule or harvest time (see Appendix 2 for site specifics). The study design and sample collection was conducted according to the guidelines developed by Edmiston *et al.* (1990). Samples were collected from the north side of the row of the treatment plots.

Each sample consisted of forty leaf disks collected with a Birkestrand leaf punch, 2.523 cm (0.993 inches) in diameter. The sampler excises a disk from the leaf and places it in a clean jar. Leaf samplers were cleaned after collection of each sample.

Samples were taken from forty vines of similar canopy density from the twentieth vine on, counted from the outside of the plot, except for site 4 (Table 3). The same forty vines were sampled throughout the sampling intervals (Table 3) and at least 35% of the time the same leaf was punched at different intervals. One to three-year-old replanted vines were screened out. Samples were taken from mature leaves that were fully-grown when vines were treated. For each treatment and sampling interval, four samples were collected from inside the canopy and four samples were collected from outside the canopy. Leaf disks collected from outside the canopy were sampled from the outermost leaves, at or above the second wire (directly exposed to the spray). Leaf disks collected from inside the canopy were sampled between the first and the second wire, and as near the clusters as possible. These fruit zones were in deep shade due to overhanging shoots, except for site 3. Sample jars were sealed with a Teflon-lined lid, placed in plastic, track-seal bags and stored on ice until delivery to the analytical laboratory the same day, except day three, from Site 1 (collected on a Sunday). DFR samples were not frozen. Field staff completed a chain of custody (COC) form for the samples. Laboratory staff completed the COC upon receipt of the samples.

Canopy Characteristics: Pictures were taken (Figures 1, 3, 8 and 9) and canopy density was estimated based on representative vines similar to those from which leaf disks were taken. Canopy density affects pesticide deposition on the leaves. Canopy density is the amount of leaf area within a given canopy volume. It is instructive to separate main and lateral leaves, and to

Fig. 8. Canopy density on site 3. Notice new growth in early May and some shoots on the ground after shoot thinning on this Zinfandel block.


Fig. 9. Canopy density on site 4 (Cabernet sauvignon).

record shoot length. Four shoots per treatment were chosen before application for measuring leaf area component. Leaf area can be measured with electronic meters and other methods (Smart, 1984; Smart *et al.*, 1985; Smart and Smith, 1988; Kliewer, 1990). A random shoot from the middle of the cordon was chosen. The following parameters were evaluated: *(a)* total primary shoot length; *(b)* number of nodes per shoot; *(c)* leaf area of main and lateral shoots measured with a LICOR leaf area meter model 3100, Li-Cor, Lincoln, Nebraska (Appendix 8); *(d)* vine height (Table 2). Also, number of shoots per spur was counted on sites 3, 4, and 5 in the fall (Appendix 8). Leaf area per vine was determined by multiplying leaf area per shoot with the average number of spurs per vine times the number of shoots per spur (Appendix 8).

During the spray application pruning sheers mounted in the front of the tractor cut back the canes, a common practice to allow better penetration of the spray droplets into the canopy. Canes were cut five feet away from the vine pole at all study sites. Shoot thinning was done three days before spraying the first myclobutanil application at site 3 and for the rest of the sites was also done in May.

Sample Analysis: Laboratory analysis was for myclobutanil. The California Department of Food and Agriculture (CDFA), Center for Analytical Chemistry conducted all analytical work following applicable standard operating procedures. Samples were extracted within 24 to 48 hours after collection.

Fifty mL of distilled water and 0.2 mL of 0.02% aqueous solution of sodium dioctyl sulfosuccinate (Aerosol OT-75, Cytec Industries) in a mixture of ethanol and water was added to the leaf disk samples. The samples were rotated end-over-end for 30 minutes, at 30 rpm. The process was repeated three times. All three washings were decanted into a 250 mL graduated-cylinder, and the total volume (approximately 150 mL) transferred to a 500 mL separatory funnel, which contained 40 grams of sodium chloride. The funnel was shaken to dissolve the salt.

The aqueous extract was extracted three times with 50 mL water-saturated ethyl acetate each time. The extracts were drained through sodium sulfate into a 500 mL boiling flask. The dried ethyl acetate was concentrated to <5 mL using rotary evaporation with a water bath set at 60°C, transferred to volumetric glassware, and made to 10 mL for analysis.

In 1996, the DFR samples were analyzed using a Varian 3400 gas chromatography with a capillary DB-17 column and Saturn Ion Trap Detector (ITD). The chromatography was done on a 15m x 0.25 mm x 0.25 µm DB-17 column at 10 psi. The initial temperature column was 60° C per 0.1 min, programmed at 20° C/min to 150° C, at 9° C/min to 240° C, and held at 240° C for 6 min. The split/splitless injector was operated in splitless mode with the temperature at 220° C. The transfer line temperature was 240° C.

The ITD was programmed using the Selected Ion System to acquire 100-450 amu ions at 1 scan/sec for 15 min. The 179 and 288 ions were used for quantification. No special tuning procedures were used. The detector manifold temperature was 180° C, and detector filament/multiplier turn-on delay was 3 minutes.

In 1997, high performance liquid chromatography (HPLC) analysis was used. The instrument was a Hewlett-Packard 1050 liquid chromatography/ultra violet (LC/UV) system equipped with a 15 cm × 4.6 mm Alltech Absorbosphere C8 column. The gradient was 10/90 to 90/10 Acetonitrile/water % in 15 minutes with a 3 minute hold, followed by a reset to 10/90, and a stop time of 22 min. These conditions resulted in a retention time of 12 minutes. The UV detector was monitoring 223 nm, and 10 μL was injected. One-percent methyl alcohol is added to the LC water to retard microbe growth.

Three-point standard curves were run every 8 - 10 samples, typically. The limit of detection for myclobutanil was 2 μg/sample (sites 3 & 4), 3 μg/sample (site 5) and 5 μg/sample (sites 1 & 2), depending on column conditioning, so a constant reporting limit was maintained for each site. Laboratory recoveries from fortifications of blank extracts were reported, and range from 73 – 112% (Appendix 7). The data was not corrected for recoveries.

Tank mix and nozzle samples were analyzed by HPLC and reported in Appendix 6. Laboratory fortification was not performed on these samples as the results of tank and nozzles were almost identical, except for Site 2, the conventional tank mix was higher than the intended rate.

Data Analysis: Analytical results reported in micrograms per sample (Appendix 2) were divided by 400 square centimeters, corresponding to the surface area of 40 leaf punches. Experiments were carried out with five replications. Microsoft Excel© version 7.0a was used to perform the exponential regressions on the natural log of the results (μg/cm²). The half-life, *t ½,* is equal to 0.693τ, and τ is a characteristic time or decay constant. However, the regression intercepts reflect background residue resulting from previous applications (Site 1, 4, and 5). Analysis of variance (ANOVA) and Tukey's test were used to test the significance of the effect of sprayer type on initial deposition. All tests regarding statistical significance were done at $\alpha = 0.05$ level.

To compare initial deposition between treatments and locations a two-way Treatment by Location ANOVA (Myers, 1972) was done on Day 1 DFR adjusted for background. The adjustment was done by subtracting from each Day 1 sample the corresponding background sample (or the mean for Site/Treatment/Location if no corresponding background sample were available, as in the case of Site 1). Background samples that were below the detection limit were treated as zeroes when all four samples were none detected; when 50% and 25% of the samples were none detected the whole and half value of the limit of quantification (LOQ) was used respectively. The four adjusted samples were averaged, and the natural logarithm of the average used as the dependent variable. Treatment was a between-replicates factor in the ANOVA while Location was a repeated factor.

To test the effects of application method (Treatment) and inside- *vs.* outside-canopy location (Location) on DFR dissipation, regression models were fit to the data using SAS PROC REG (SAS Institute, 1989). For all analysis, the four samples taken each day at each Site/Treatment/Location combination were averaged and the natural logarithm of the average used as the dependent variable. All tests of significance were at the $\alpha = 0.05$ level. Initially, the model

$$\ln \text{DFR} = \beta_0 + \beta_1 \text{day} + \beta_2 \text{day}^2 + \beta_3 L + \beta_4 \text{day*L} + \beta_5 T_1 + \beta_6 T_2 + \beta_7 L{*}T_1 + \beta_8 L{*}T_2 + \beta_9 \text{day*}T_1 + \beta_{10} \text{day*}T_2 + \beta_{11} \text{day*L*}T_1 + \beta_{12} \text{day*L*}T_2 + \beta_{13} \text{day}^2\text{*L} + \beta_{14} \text{day}^2{*}T_1 + \beta_{15} \text{day}^2{*}T_2 + \beta_{16} \text{day}^2\text{*L*}T_1 + \beta_{17} \text{day}^2\text{*L*}T_2$$

was fit. The variable Day is the number of days after application. L is a dummy variable for location, with the value of 0 for outside and 1 for inside the canopy. The variables T_1 and T_2 are dummy variables for treatment: T_1 has the value 1 for conventional full rate, 0 for others; T_2 has the value 1 for electrostatic half rate, 0 for others. The interpretation of the coefficients of the model is as follows:

β_0	intercept for Electrostatic Full Rate (EFR), Outside,
β_1 and β_2	linear (slope) and quadratic components of time for EFR Outside,
β_3	difference between intercepts of Inside and Outside for EFR,
β_4	difference between slopes of Inside and Outside for EFR,
β_5	difference between intercepts of Conventional Full Rate (CFR) and EFR for Outside,
β_6	difference between intercepts of Electrostatic Half Rate (EHR), and EFR for Outside,
β_7	increment to β_5 due to being Inside,
β_8	increment to β_6 due to being Inside,
β_9	difference between slopes of CFR and EFR for Outside,
β_{10}	difference between slopes of EHR and EFR for Outside,
β_{11}	increment to β_9 due to being Inside,
β_{12}	increment to β_{10} due to being Inside,
β_{13}	difference between quadratic components of Inside and Outside,
β_{14}	difference between quadratic components of CFR and EFR for Outside,
β_{15}	difference between quadratic components of EHR and EFR for Outside,
β_{16}	increment to β_{14} due to being Inside,
β_{17}	increment to β_{14} due to being Inside.

The intercept terms reflect initial deposition plus background residue, while the slopes reflect dissipation rate.

Effects were tested by adding each term to the model in a stepwise manner and testing whether the reduction in the error sum-of-squares were significant at the $\alpha = 0.05$ level.

The next step was to fit the reduced model, i.e., the model including only those terms that were significant, and use it to calculate predicted *ln* DFR for each day to 30 days after application. Predicted *ln* DFR was back-transformed to predicted DFR in $\mu g/cm^2$ using the Bradu-Mundlak unbiased estimator of the mean of a lognormal distribution (Powell, 1991). Prediction limits for $\mu g/cm^2$ DFR were calculated by simply exponentiating the limits for *ln* DFR. (The 90% prediction interval is the range within which mean DFR of 90 percent of the sites would be expected to fall if the study were repeated.)

Table 6. Contrasts tested in regression analysis.

Contrast	Represents Difference Between
$-3*\beta_4 - \beta_{11} - \beta_{12}$	average slopes of Outside and Inside canopy
$-2*\beta_9 - \beta_{11}$	average slopes of EFR and CFR
$2*\beta_9 - 2*\beta_{10} + \beta_{11} - \beta_{12}$	average slopes of CFR and EHR
$-2*\beta_{10} - \beta_{12}$	average slopes of EFR and EHR
$-3*\beta_3 - \beta_7 - \beta_8$	average intercepts of Outside and Inside canopy
$-2*\beta_5 - \beta_7$	average intercepts of EFR and CFR
$2*\beta_5 - 2*\beta_6 + \beta_7 - \beta_8$	average intercepts of CFR and EHR
$-2*\beta_6 - \beta_8$	average intercepts of EFR and EHR
$-\beta_3$	intercepts of EFR Outside and EFR Inside canopy
$-\beta_3 - \beta_7$	intercepts of CFR Outside and CFR Inside canopy
$-\beta_3 - \beta_8$	intercepts of EHR Outside and EHR Inside canopy
$\beta_5 - \beta_6$	intercepts of CFR and EHR- Outside canopy
$\beta_5 - \beta_6 + \beta_7 - \beta_8$	intercepts of CFR and EHR - Inside canopy
$-\beta_5$	intercepts of EFR and CFR - Outside canopy
$-\beta_5 - \beta_7$	intercepts of EFR and CFR - Inside canopy
$-\beta_6$	intercepts of EFR and EHR - Outside canopy
$-\beta_6 - \beta_8$	intercepts of EFR and EHR - Inside canopy

EHR = Electrostatic Half Rate   EFR = Electrostatic Full Rate   CFR = Conventional Full Rate

Differences between specific treatments were tested as contrasts (linear combinations) of the parameters of the reduced regression model. Table 6 lists all the contrasts in their full forms. In the form they were actually tested, any non-significant parameters were omitted from the expressions. In each case, H_0: Contrast = 0 *vs*. H_A: Contrast $\neq$ 0 was tested against the mean-squared-error of the overall regression model.

Meteorological Data Collection: Meteorological parameters were downloaded from the California Irrigation Management Information System (CIMIS) for Station 42, located in northern San Joaquin County. Records were obtained daily (Appendix 5) for the duration of the study, and hourly for the time spent on the applications (Appendix 4). Also, site 1 and 5 had daily and hourly observations recorded by a University of California Extension meteorological station located at Lodi (Appendix 4). The study director monitored relative wind velocity and direction, presence of dew, and cloud cover at the time of each application (Table 5).

The protocol for project 9604 “Dislodgeable foliar residues following reduced-volume and conventional myclobutanil application on grapes” was approved and signed by the Study Director and Quality Assurance Officer on 16 July 1996. The study followed applicable branch standard operating procedures for protocol, protocol development, sampling, and sample identification, shipping, reporting and archiving data. The experiment began on 14 July 1996 and terminated on 29 July 1997.

Results

At the study sites, myclobutanil applications began at pre-bloom with approximate 18-day treatment intervals. A total of 3 - 4 myclobutanil applications were made prior to initiation of the study at sites 1, 4 and 5; therefore the samples before application show some myclobutanil on the leaves. Sites 2 and 3 had no previous myclobutanil application, thus pre-application samples had no detected fungicide.

Tank and nozzle sample results were almost identical, except for Site 2 - CFR. The active ingredient results were close to the intended application rates, for the rest of the sites. There were no tank mix or nozzle samples taken in 1997 due to safety procedures established by the branch.

The adjusted Day 1 treatment means are given in Table 7; site 2 was excluded due to questionable results on day one. The ANOVA test of initial deposition, as represented by Day 1 samples, found no significant differences between treatments or locations. The interaction approached significance ($p = 0.11$), with greater deposition inside with conventional, and greater deposition outside with the electrostatic applications. The statistical power of this analysis was low.

Table 7. Mean adjusted and unadjusted Day 1 dislodgeable foliar residue (µg/cm²).

	Canopy location	**EHR**	**EFR**	**CFR**	**Location mean**
Adjusted *	IN	0.091 (0.065)**	0.189 (0.147)	0.172 (0.054)	0.151 (0.105)
	OUT	0.120 (0.054)	0.253 (0.085)	0.131 (0.095)	0.168 (0.099)
	Treatment mean	0.106 (0.061)	0.221 (0.123)	0.151 (0.079)	
Unadjusted***	IN	0.144 (0.070)	0.300 (0.138)	0.259 (0.043)	0.234 (0.112)
	OUT	0.146 (0.613)	0.287 (0.080)	0.143 (0.087)	0.192 (0.101)
	Treatment mean	0.145 (0.065)	0.293 (0.111)	0.201 (0.089)	

*Adjusted = Day 1 deposition minus background residue.
**(SD) = Standard deviation
***Unadjusted = Day 1 deposition with background residue.
EHR = Electrostatic Half Rate EFR = Electrostatic Full Rate CFR = Conventional Full Rate
Mean = data from site 1, 3, 4 and 5.

In the overall regression analysis of residue dissipation (all five sites), none of the higher-order terms involving Day² was significant. Day² itself was significant, but because it contributed less than 2 percent to R^2, it was dropped from the model. The terms β_0, β_1, β_4, β_5, β_6, and β_7 were significant. R^2 for the model including only the 6 significant terms was 0.540, while for the full 17-parameter model it was 0.563.

The reduced model including only the significant terms from the first step was estimated next. The parameters β_5 and β_6 were constrained to be equal in the estimation because they did not differ significantly in Step 1.

Table 8. Parameter estimates for the reduced model.

Variable	Parameter	Estimate
Intercept	β_0	-1.392
Day	β_1	-0.0748
Day*Location	β_4	0.0442
T_1	β_5	-0.7468
T_2	β_6	-0.7468
Location*T_1	β_7	0.6880

T_1 = difference between intercepts of CFR and EFR, for Outside.
T_2 = difference between intercepts of EHR and EFR, for Outside.
β_0 = intercept for Electrostatic Full Rate (EFR), Outside; β_1 = slope of time for EFR, Outside; β_4 = difference between slopes of Inside and Outside for EFR; β_5 = difference between intercepts of Conventional Full Rate (CFR) and EFR for Outside; β_6 = difference between intercepts of Electrostatic Half Rate (EHR), and EFR for Outside; β_7 = increment to β_5 due to being inside.

Table 9. Regression equation for each treatment-location combination constructed from the parameter estimates for the reduced model.

Treatment-Canopy location	Intercept		Slope	
EFR Outside	β_0	= -1.39	β_1	= -0.075
CFR Outside	$\beta_0 + \beta_5$	= -2.14	β_1	= -0.075
EHR Outside	$\beta_0 + \beta_6$	= -2.14	β_1	= -0.075
EFR Inside	β_0	= -1.39	$\beta_1 + \beta_4$	= -0.031
CFR Inside	$\beta_0 + \beta_5 + \beta_7$	= -1.45	$\beta_1 + \beta_4$	= -0.031
EHR Inside	$\beta_0 + \beta_6$	= -2.14	$\beta_1 + \beta_4$	= -0.031

EHR = Electrostatic Half Rate. EFR = Electrostatic Full Rate. CFR = Conventional Full Rate.
β_0 = intercept for EFR, Outside.
β_5 = difference between intercepts of CFR and EFR for Outside;
β_6 = difference between intercepts of EHR, and EFR for Outside;
β_4 = difference between slopes of Inside and Outside for EFR.

The application method (treatment) had no significant effect on dissipation rate. Only canopy location had a significant effect, with dissipation inside the canopy being much slower than outside. Dissipation half-lives calculated from the fitted slopes were 23 days inside and 9.3 days outside the canopy.

Tables 10, 11 and 12 give predicted mean DFR in µg/cm², and 90% prediction limits, by day after application. These predicted values are not exactly equal to what would be obtained by exponentiating the predicted *ln* DFR calculated from the regression equation. The tabled values have been corrected for the bias present in the simple exponent. It must be noted that the starting value in each case is based on data unadjusted for background, so it includes any residue present prior to the applications.

The DFR data obtained in 1996 and 1997 are shown in Appendix 2. Estimated parameters representing the fitted decay curves for the individual sites spray application are shown in Appendix 10. The curves and average observed data are graphically shown in Figures 10, 11, and 12. Degradation curves for the individual sites are graphically shown in Appendix 3 - Figures 1, 2 and 3: four data points each for inside canopy and outside canopy are shown for each treatment. The regression intercepts reflect background residue in addition to initial deposition. Three of the five sites had detectable background residue resulting from prior applications.

The average of inside and outside canopy for sites 1, 3, 4 and 5 (Table 7) resulted in the highest initial deposition, represented by Day 1 samples in the EFR application (0.221 $\mu g/cm^2$), with the CFR intermediate (0.151 $\mu g/cm^2$), and EHR the lowest (0.106 $\mu g/cm^2$). The average Day 1 deposition for EHR was approximately half of the EFR (48%) and CFR was 68% of the EFR. The results from the outside canopy location (Table 7), and when averaging all sites except site 2 showed EFR resulted with the highest deposition (0.253 $\mu g/cm^2$) followed by CFR (0.131 $\mu g/cm^2$) and EHR (0.120 $\mu g/cm^2$); CFR and EHR were approximately half the EFR. Initial deposition, represented by Day 1, from inside canopy showed no significant differences between the EFR and CFR (0.189 vs. 0.172 $\mu g/cm^2$); EHR (0. 091 $\mu g/cm^2$) was approximately half (48%) the deposition found on EFR (Table 7).

Figures 1, 3, 8, and 9 and Appendix 8 document the different canopy density. In 1996, leaf surface area was not measured for site 1 and 2. Visually site 1 was intermediate in foliage density and site 2 appeared the densest. At the time of application in early May, Site 3 was the least dense (Fig 8). Shoots were new and not hanging over the trellis and had an average length of 126 cm and a leaf area of 35,259,618 cm^2 per acre (Appendix 8). The shoot laterals were short and less in number. Site 5 was intermediate in foliage density (Fig. 3) and site 4 was the densest (Fig. 1 and 9). On site 4 and 5 the shoots were long but at the time of application they were cut back by pruning sheers showing an average shoot length of 147 cm. Also, shoot laterals become longer and more numerous as the season progresses. Site 4 (Cabernet sauvignon) showed the densest canopy with a leaf area of 125,491,095 cm^2 per acre (Appendix 8).

Table 10. Electrostatic full rate - inside canopy, and electrostatic full rate - outside canopy: predicted mean and 90% prediction interval for myclobutanil dislodgeable foliar residue (μg/cm^2) by day after application.

	Electrostatic Full Rate - Inside Canopy			Electrostatic Full Rate - Outside Canopy		
Day	Mean	Lower limit	Upper limit	Mean	Lower limit	Upper limit
0	0.2954	0.0917	0.6743	0.2954	0.0917	0.6743
1	0.2866	0.0890	0.6533	0.2742	0.0852	0.6251
2	0.2781	0.0864	0.6331	0.2546	0.0791	0.5795
3	0.2698	0.0839	0.6135	0.2363	0.0735	0.5374
4	0.2617	0.0814	0.5947	0.2193	0.0682	0.4984
5	0.2538	0.0790	0.5766	0.2035	0.0633	0.4624
6	0.2462	0.0766	0.5591	0.1889	0.0588	0.4290
7	0.2388	0.0743	0.5423	0.1753	0.0545	0.3981
8	0.2316	0.0721	0.5260	0.1627	0.0506	0.3695
9	0.2246	0.0699	0.5103	0.1509	0.0469	0.3430
10	0.2178	0.0677	0.4952	0.1400	0.0435	0.3184
11	0.2112	0.0656	0.4806	0.1299	0.0404	0.2957
12	0.2047	0.0636	0.4665	0.1205	0.0374	0.2746
13	0.1985	0.0616	0.4530	0.1118	0.0347	0.2551
14	0.1924	0.0597	0.4399	0.1037	0.0322	0.2370
15	0.1865	0.0578	0.4272	0.0962	0.0298	0.2203
16	0.1808	0.0560	0.4150	0.0892	0.0276	0.2047
17	0.1752	0.0542	0.4032	0.0827	0.0256	0.1903
18	0.1698	0.0525	0.3918	0.0767	0.0237	0.1769
19	0.1646	0.0508	0.3808	0.0711	0.0219	0.1645
20	0.1595	0.0491	0.3701	0.0659	0.0203	0.1530
21	0.1546	0.0475	0.3598	0.0611	0.0188	0.1423
22	0.1498	0.0460	0.3499	0.0567	0.0174	0.1324
23	0.1451	0.0445	0.3403	0.0525	0.0161	0.1232
24	0.1406	0.0430	0.3310	0.0487	0.0149	0.1147
25	0.1362	0.0416	0.3220	0.0451	0.0138	0.1068
26	0.1319	0.0402	0.3133	0.0418	0.0128	0.0994
27	0.1278	0.0389	0.3049	0.0388	0.0118	0.0925
28	0.1238	0.0376	0.2968	0.0359	0.0109	0.0862
29	0.1199	0.0363	0.2889	0.0333	0.0101	0.0803
30	0.1161	0.0351	0.2813	0.0309	0.0093	0.0748

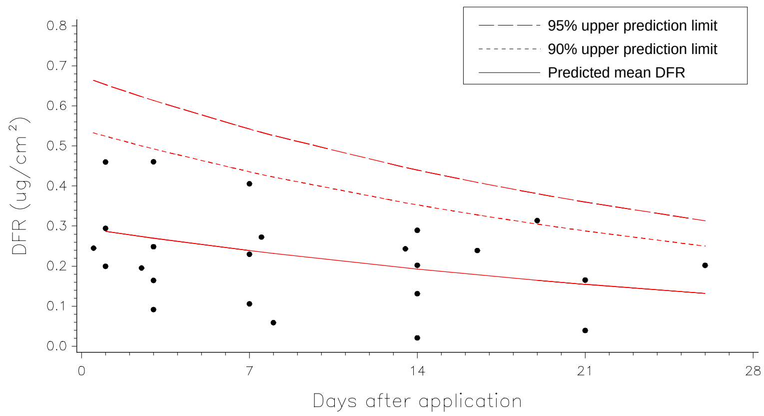
Table 11. Electrostatic half rate - inside canopy, electrostatic half rate and conventional full rate - outside and conventional full rate - inside canopy. Predicted mean and 90% prediction interval for myclobutanil dislodgeable foliar residue (μg/cm^2) by day after application.

Day	Electrostatic Half Rate Inside Canopy			EHR and Conventional Full Rate - Outside Canopy			Conventional Full Rate Inside Canopy		
	Mean	Lower limit	Upper limit	Mean	Lower limit	Upper limit	Mean	Lower limit	Upper limit
0	0.1401	0.0436	0.3186	0.1401	0.0436	0.3186	0.2773	0.0854	0.6438
1	0.1360	0.0423	0.3087	0.1301	0.0405	0.2952	0.2691	0.0830	0.6234
2	0.1319	0.0411	0.2992	0.1208	0.0376	0.2737	0.2611	0.0806	0.6038
3	0.1280	0.0399	0.2900	0.1121	0.0349	0.2537	0.2533	0.0782	0.5849
4	0.1241	0.0387	0.2811	0.1041	0.0325	0.2353	0.2458	0.0760	0.5667
5	0.1204	0.0375	0.2726	0.0966	0.0301	0.2182	0.2385	0.0737	0.5491
6	0.1168	0.0364	0.2644	0.0897	0.0280	0.2024	0.2314	0.0716	0.5322
7	0.1132	0.0353	0.2565	0.0832	0.0260	0.1878	0.2244	0.0694	0.5159
8	0.1098	0.0342	0.2488	0.0772	0.0241	0.1743	0.2177	0.0674	0.5002
9	0.1065	0.0332	0.2415	0.0716	0.0224	0.1618	0.2111	0.0654	0.4850
10	0.1033	0.0321	0.2343	0.0665	0.0207	0.1502	0.2048	0.0634	0.4704
11	0.1001	0.0311	0.2275	0.0617	0.0192	0.1394	0.1986	0.0615	0.4563
12	0.0971	0.0302	0.2209	0.0572	0.0178	0.1295	0.1926	0.0596	0.4427
13	0.0941	0.0292	0.2145	0.0531	0.0165	0.1203	0.1868	0.0578	0.4296
14	0.0912	0.0283	0.2083	0.0492	0.0153	0.1117	0.1811	0.0560	0.4170
15	0.0884	0.0274	0.2023	0.0457	0.0142	0.1038	0.1756	0.0543	0.4048
16	0.0857	0.0265	0.1966	0.0424	0.0132	0.0964	0.1702	0.0526	0.3930
17	0.0831	0.0257	0.1910	0.0393	0.0122	0.0896	0.1650	0.0509	0.3816
18	0.0805	0.0249	0.1856	0.0364	0.0113	0.0833	0.1600	0.0493	0.3706
19	0.0780	0.0241	0.1805	0.0338	0.0105	0.0775	0.1550	0.0478	0.3600
20	0.0756	0.0233	0.1754	0.0313	0.0097	0.0720	0.1503	0.0462	0.3498
21	0.0732	0.0225	0.1706	0.0290	0.0090	0.0670	0.1456	0.0448	0.3399
22	0.0710	0.0218	0.1659	0.0269	0.0083	0.0623	0.1411	0.0433	0.3303
23	0.0687	0.0211	0.1614	0.0250	0.0077	0.0580	0.1368	0.0419	0.3211
24	0.0666	0.0204	0.1570	0.0231	0.0071	0.0540	0.1325	0.0406	0.3122
25	0.0645	0.0197	0.1528	0.0215	0.0066	0.0502	0.1284	0.0392	0.3036
26	0.0625	0.0190	0.1487	0.0199	0.0061	0.0468	0.1244	0.0379	0.2952
27	0.0605	0.0184	0.1447	0.0184	0.0056	0.0435	0.1205	0.0367	0.2872
28	0.0586	0.0178	0.1409	0.0171	0.0052	0.0405	0.1168	0.0355	0.2794
29	0.0568	0.0172	0.1372	0.0158	0.0048	0.0377	0.1131	0.0343	0.2718
30	0.0550	0.0166	0.1336	0.0147	0.0045	0.0352	0.1096	0.0332	0.2646

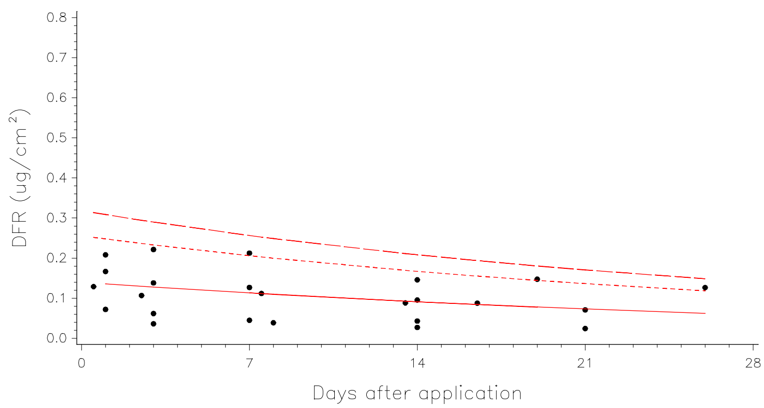
EHR = Electrostatic Half Rate

Table 12. Electrostatic full rate, electrostatic half rate and conventional full rate (average inside and outside canopy): predicted mean and 90% prediction interval for myclobutanil dislodgeable foliar residue (μg/cm^2) by day after application.

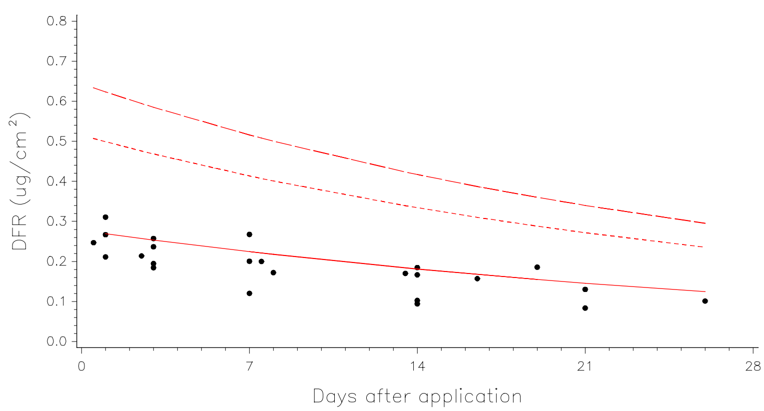
Day	Electrostatic Full Rate			Electrostatic Half Rate			Conventional Full Rate		
	Mean	Lower limit	Upper limit	Mean	Lower limit	Upper limit	Mean	Lower limit	Upper limit
0	0.3191	0.0748	0.8262	0.1512	0.0355	0.3914	0.2133	0.0500	0.5524
1	0.3029	0.0711	0.7828	0.1435	0.0337	0.3709	0.2025	0.0475	0.5234
2	0.2875	0.0675	0.7417	0.1362	0.0320	0.3514	0.1922	0.0451	0.4959
3	0.2729	0.0641	0.7030	0.1293	0.0304	0.3330	0.1824	0.0429	0.4700
4	0.2590	0.0609	0.6663	0.1227	0.0289	0.3157	0.1732	0.0407	0.4455
5	0.2458	0.0578	0.6316	0.1164	0.0274	0.2993	0.1643	0.0387	0.4223
6	0.2332	0.0549	0.5989	0.1105	0.0260	0.2837	0.1559	0.0367	0.4004
7	0.2213	0.0521	0.5679	0.1048	0.0247	0.2691	0.1480	0.0348	0.3797
8	0.2100	0.0494	0.5386	0.0995	0.0234	0.2552	0.1404	0.0330	0.3601
9	0.1992	0.0469	0.5109	0.0944	0.0222	0.2421	0.1332	0.0314	0.3416
10	0.1890	0.0445	0.4847	0.0895	0.0211	0.2296	0.1264	0.0297	0.3241
11	0.1793	0.0422	0.4599	0.0849	0.0200	0.2179	0.1199	0.0282	0.3075
12	0.1701	0.0400	0.4364	0.0806	0.0190	0.2068	0.1137	0.0268	0.2918
13	0.1613	0.0380	0.4142	0.0764	0.0180	0.1962	0.1078	0.0254	0.2769
14	0.1530	0.0360	0.3932	0.0725	0.0170	0.1863	0.1023	0.0241	0.2629
15	0.1451	0.0341	0.3733	0.0687	0.0162	0.1769	0.0970	0.0228	0.2496
16	0.1376	0.0323	0.3545	0.0652	0.0153	0.1679	0.0920	0.0216	0.2370
17	0.1305	0.0306	0.3366	0.0618	0.0145	0.1595	0.0872	0.0205	0.2251
18	0.1237	0.0290	0.3197	0.0586	0.0138	0.1515	0.0827	0.0194	0.2138
19	0.1173	0.0275	0.3037	0.0556	0.0130	0.1439	0.0784	0.0184	0.2031
20	0.1112	0.0261	0.2886	0.0527	0.0123	0.1367	0.0743	0.0174	0.1929
21	0.1054	0.0247	0.2742	0.0499	0.0117	0.1299	0.0705	0.0165	0.1833
22	0.0999	0.0234	0.2606	0.0473	0.0111	0.1235	0.0668	0.0156	0.1742
23	0.0947	0.0221	0.2477	0.0449	0.0105	0.1174	0.0633	0.0148	0.1656
24	0.0898	0.0210	0.2355	0.0425	0.0099	0.1116	0.0600	0.0140	0.1574
25	0.0851	0.0198	0.2239	0.0403	0.0094	0.1061	0.0569	0.0133	0.1497
26	0.0806	0.0188	0.2129	0.0382	0.0089	0.1009	0.0539	0.0126	0.1423
27	0.0764	0.0178	0.2025	0.0362	0.0084	0.0959	0.0511	0.0119	0.1354
28	0.0724	0.0168	0.1926	0.0343	0.0080	0.0912	0.0484	0.0112	0.1288
29	0.0686	0.0159	0.1832	0.0325	0.0075	0.0868	0.0459	0.0106	0.1225
30	0.0650	0.0150	0.1743	0.0308	0.0071	0.0826	0.0435	0.0101	0.1165



(a) Electrostatic Full−Rate Application

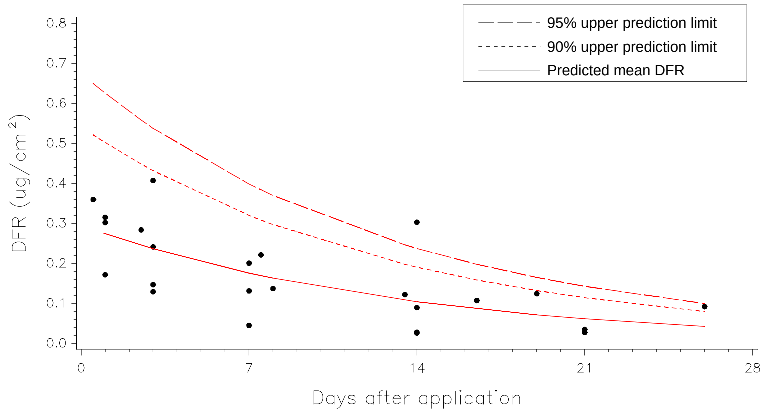


(b) Electrostatic Half−Rate Application

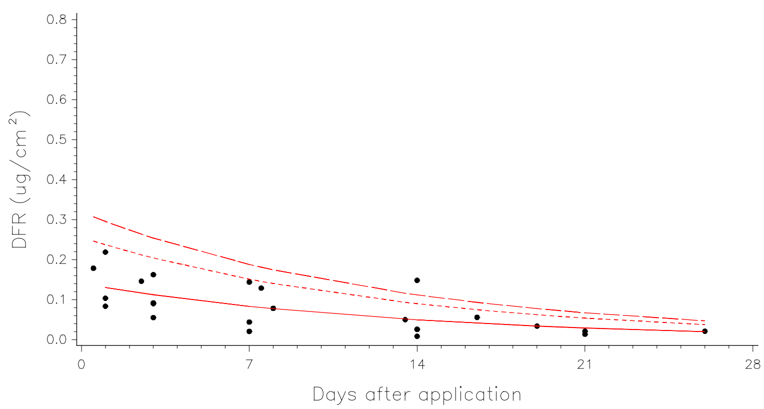


(c) Conventional Application

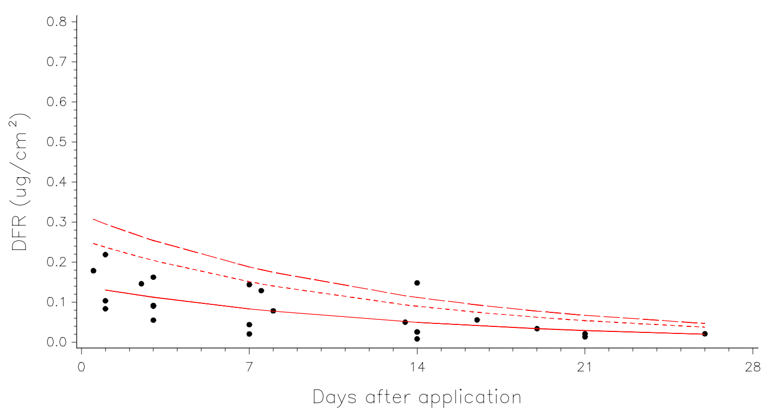
Figure 10. Myclobutanil dislodgeable foliar residue on the inside grape canopy following full-rate electrostatic (4 oz per acre in 8 - 10 gal), one-half rate electrostatic (2 oz per acre in 8 - 10 gal) and conventional application (4 oz per acre in 80 - 100 gal).



(a) Electrostatic Full−Rate Application

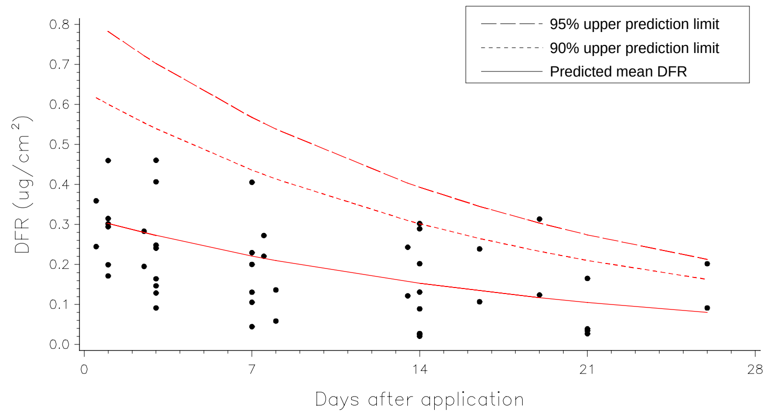


(b) Electrostatic Half−Rate Application

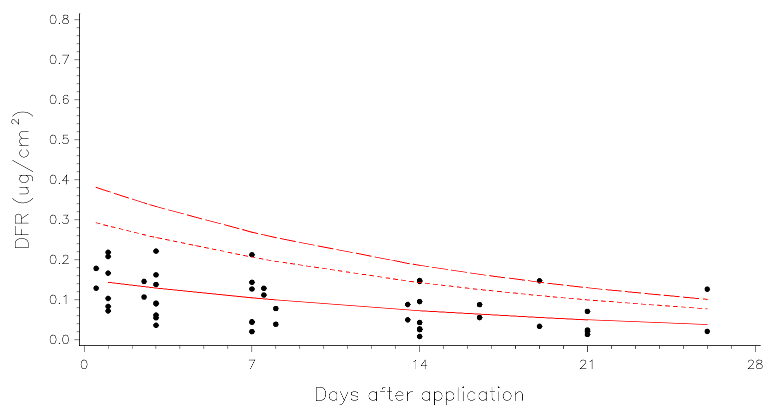


(c) Conventional Application

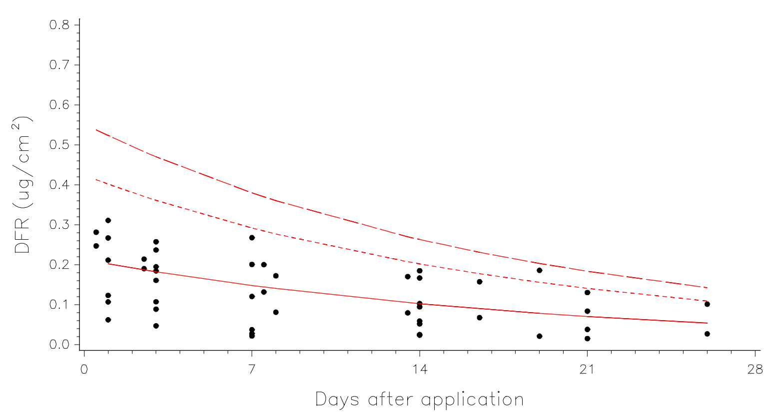
Figure 11. Myclobutanil dislodgeable foliar residue on the outside grape canopy following full-rate electrostatic (4 oz per acre in 8 - 10 gal), one-half rate electrostatic (2 oz per acre in 8 - 10 gal) and conventional application (4 oz per acre in 80 - 100 gal)



(a) Electrostatic Full–Rate Application



(b) Electrostatic Half–Rate Application



(c) Conventional Application

Figure 12. Myclobutanil dislodgeable foliar residue on the grape canopy (average of inside-outside) following full-rate electrostatic (4 oz per acre in 8 - 10 gal), one-half rate electrostatic (2 oz per acre in 8 - 10 gal) and conventional application (4 oz per acre in 80 - 100 gal).

Air temperatures during application were 64, 64, and 63°F (17.8, 17.8, and 17.2°C) at sites 3, 4, and 5, respectively. Other meteorological conditions that were measured during the applications were as follows: relative humidity, 56, 77, and 80%; soil temperature, 72, 64, and 59°F (22.2, 17.8, and 15°C). Soil moisture was dry at site 3 and 4, with moist condition at site 5. Wind direction and wind speed is given in Table 5. In 1996, at the time of applications on site 1 and 2 it was determined that it was not necessary to record individual meteorological conditions, as the weather station was on site 1 and site 2 was approximately four miles away from it. No rain occurred during or after application (Appendices 4 and 5).

A one-way ANOVA was run to compare the overall mean temperatures of the five sites during the study period. Results throughout the monitoring period show mean temperatures (Appendix 9) at site 1, 2 and 5 were significantly higher than site 3 and 4. Site 5 was intermediate and was not significantly different from site 4 and 3. Therefore, the Chardonnay block (sites 1 and 5) daily mean temperature was not significantly different between 1996 and 1997.

Discussion

The application process is affected by an array of factors: some human and some mechanical. One of the reasons for the differences in pesticide deposition between the sites could be due to technology differences between the grower's electrostatic sprayers. For the conventional application a Rear's Miniblast was used at all the sites. Application rate and airflow rate (Pergher and Gubiani, 1995), tractor speed (Salyani and Whitney, 1990b), nozzle set-up, and weather conditions (Hoffmann and Salyani, 1996) might also affect deposition. As shown in Appendix 1 and Table 5, there were slight differences in the tractor ground speed within the sites. Table 4 describes the different nozzle set up and other application parameters. Nevertheless, the fungicide was sprayed at +/-10% of intended rate per acre, except for site 2, where the tank mix was 66% greater than intended.

In this study, initial deposition as represented by Day 1 samples, obtained outside the canopy was nonsignificantly higher for EFR than CFR (Table 7). EFR and CFR gave similar deposition inside the canopy. When results were averaged for inside and outside the canopy and for sites 1, 3, 4 and 5 they showed that the EFR resulted in the highest foliar deposition, followed by the CFR. CFR attained 68% of the EFR deposition. The EHR gave the lowest foliar deposition and was equivalent to half the EFR deposition. It also achieved approximately 70% of the deposition obtained with CFR. It should be emphasized that initial deposition outside the canopy with EFR was twice the deposition obtained with CFR and EHR. However inside the canopy, EFR and CFR gave similar deposition, while EHR resulted in half of the EFR and CFR deposition. At site 2, CFR exhibited the highest initial deposition inside the canopy compared to the other treatment (Appendix 3 - Fig. 3-1). This could be due to a 66% higher concentration on the tank than the rate intended to be applied (Appendix 6).

These replicated field trials attempted to assess the effect of conventional and electrostatic application on initial pesticide deposition and dissipation rate. Unfortunately, due to the low number of replicates per treatment (5), the effects of the application system were not distinguished in great detail by statistical analysis, since the experimental sensitivity was lowered by the sample size.

Studies have shown that the distribution of insecticides on the foliage varies appreciably, depending on the distance between the foliage and the sprayer (Fischer and Hikichi, 1973). Leaves on the outside of the canopy do not receive the same amount of pesticide as leaves within the tree canopy (Fischer, *et al.* 1976). Salyani reported the mean deposition of 470, 1,890, and 4,700 L/ha volume rate at various canopy locations on citrus, using a PTO-driven air-carrier (Salyani and Hoffmann, 1996) and with an engine-driven sprayer at volume rates of 235-9,400 L/ha (Salyani *et al.*, 1988; Salyani and McCoy, 1989). They found significant differences in deposition, the highest deposition being achieved at the lowest volume rate. Also, outer canopy deposition increased as spray volume decreased; however, there were no differences between application volume rates at the tree center (Salyani, 1997). Similar trends were found in the present study where the highest deposition occurred outside the canopy with the EFR treatment. However, no difference was observed inside the canopy between CFR and EFR applications.

The increase in deposition at lower volume rates was possibly due to the decrease in run-off from the leaf surface and the greater collection efficiency are for the finer sprays that probably applied to this application scenario (Salyani, 1997). Comparatively large spray droplets, produced by large nozzles at higher volume rates, either shatter upon impact or coalesce readily and run off the leaf surface, resulting in lower deposition (Mathews, 1979). With the present report a nonsignificantly lower deposition was observed with the CFR application. On the other hand, the smaller and more concentrated droplets do not coalesce or run-off the leaf surface readily and can be entrained by the sprayer air flow to reach less accessible canopy locations (Mathews, 1979; Gohlich, 1985). In general, variability of deposition expressed as the Coefficient of Variation (COV), tended to increase at inner canopy locations for the electrostatic technology (Appendix 10). It is probably more difficult for the charged drops to reach the interior canopy when compared to the Rear's system that has no charged droplets and creates more air turbulence than the electrostatic system. This study and several others observed that spray tends to deposit on the outer canopy more as electrostatically charged droplets are attracted to the nearest surface (Mathews, 1979).

Canopy density is an important observation on any application study, affecting deposition on the leaves. Dense canopies can cause inefficiencies of spray deposition/coverage. A number of studies have measured deposition patterns within plant canopies (Whitney *et al.*, 1989; Juste *et al.*, 1990; Salyani and Whitney, 1991). The discrepancy on pesticide deposition among the sites may also be due to the differences in variety, training system (Table 2) and canopy density. Hall and Reichard (1978) pointed out that tree volume per unit area of ground might vary at a particular season by about two orders of magnitude depending upon planting distances and morphology. This was also due to variety differences, as Cabernet sauvignon tends to have more shoot growth than Chardonnay. The highest deposition among the different sites and regardless of the application system was attained on the lightest canopy as seen on site 3 at the beginning of the growing season. Canopy density had more effect on the electrostatic application than the conventional, such that pesticide deposition resulted in approximately half the amount when averaging for location at site 2 and 4 with a canopy density almost twice the size of site 1 and 5.

On an electrostatic application the small size charged droplets with less wind volume have more difficulty getting inside a dense canopy.

Targets differ in reception responses to sprays, in that different plants retain greater/lesser amount of spray according to size and canopy density (Schneider *et al.*, 1997; Hall, 1991; Steinke *et al.* 1996; Iwata *et al.* 1983). Salyani and Whitney (1990a) and Whitney and Salyani (1990) attributed reduced average tracer deposits in orange trees when compared to grapefruit trees, to more dense foliage, but did not quantify the density of the foliage. Both papers also reported reduced deposits in the central portions of the trees due to difficulty in penetrating the outer canopy. There is a complex interaction between the size of the droplet, the obstacle in its path, and their relative velocity (Langmuir and Blodgett, 1946; Richardson, 1960; May and Clifford, 1967; Johnstone *et al.*, 1977). Efficiency of spray collection varies widely depending on plant density and growth stage (Hislop, 1987; Hall, 1991). In general, collection efficiency increases for finer sprays with narrower leaf sizes; and can vary substantially with droplet size, wind speed, turbulence intensity, and leaf structure and orientation (Matthews, 1979).

Effective and efficient pesticide application requires placement of the dose of a selected active ingredient on the target plants with as little drift as possible to achieve a desired biological result. However, large pesticide losses and unsatisfactory uniformity of distribution, which have often been reported for conventional axial-fan sprayers fitted with hydraulic nozzles, may reduce the effectiveness of the operation and increase environmental pollution. In apple orchards, spray losses to the ground may range from less than 2% up to 39% of the total dose applied (Planas and Pons, 1991; Buisman *et al.*, 1989), while drift losses may account for 23-45% (Planas and Pons, 1991; Raisigl *et al.*, 1991). In vineyards, total losses have been recorded ranging from 64-94%, in the first growing stages of the vines (April to May), to 44-67% at full foliage development (July to August) (Siegfried and Raisigl, 1991; Siegfried and Holliger, 1992). Pergher and Gubiani (1995) reported that the highest deposition on foliage was recorded for the combination of low spray rate and low airflow rate in a hedgerow vineyard (54.2-56.7%) when using an axial fan sprayer. Efficient pesticide application as reported in this study for the electrostatic technology suggest a reduction on pesticide application rate and/or reduction of the number of applications per growing season that would allow a reduction on the potential field worker exposure. Furthermore, the lower off-target pesticide deposition would minimize environmental contamination and potential field worker exposure.

Worker Exposure Implications: Comparisons of full-rate myclobutanil applications using the conventional and electrostatic spraying techniques found higher initial pesticide deposition outside the canopy for the electrostatic spray application. In addition no differences were observed in the inner canopy for the EFR and CFR. But when results were averaged over location and for sites 1,3,4 and 5, they indicated that CFR attained 68% of the EFR deposition. Nevertheless, pesticide deposition and decay rate was not significantly different between the two technologies. Such behavior would suggest that potential worker exposure would not increase when electrostatic spray application system was used as a direct replacement for the conventional sprayer and other pest control practices such as rate and reapplication interval remained unchanged. But some researchers have suggested that electrostatic systems might present greater exposure risk for workers if: *(a)* the sprays are more highly concentrated; *(b)* spray, being charged and seeking an object fixed to the soil, might be attracted to the workers and/or the spraying equipment - thereby increasing the risk of contamination. Potential worker exposure will depend on the trellis system, the work location on the canopy and individual work-habit behavior, and the droplet size:charge ratio. Grape field workers have potential for high dermal exposure. Welsh *et al.*, (1993), characterized different cultural tasks on grapes, with special reference to dermal exposure routes from these practices.

The application method had no effect on dissipation rate. However, canopy location had a significant effect indicating shorter decay on the outside grape foliage, and slow pesticide degradation inside the canopy. Previous work with conventional application on grapes by Welsh *et al.*, (1993) observed similar results. The slower rate of decay is not unexpected given the greater protection from ultra-violet light by the canopy. From an exposure perspective, this may be something that should be considered, as there is more foliage surface area for contact inside than outside and this would result in more exposure.

The typical industry practice is to apply myclobutanil at 18-day intervals; application intervals rarely exceed 21-days. In this study, at 18 days post-application, DFR from the CFR was 0.0827 $\mu g/cm^2$ (Table 12). For EFR application, DFR did not decay to 0.0827 $\mu g/cm^2$ until 25.5 days post-application. Assuming the 0.0827 $\mu g/cm^2$ DFR value is an accurate threshold point at which myclobutanil reapplication is necessary, use of the electrostatic application, would allow the reapplication interval to be extended to 25.5 days. These observations would probably allow a reduction of the number of applications per season, thus a potential reduction of field worker and mixer/loader/applicator exposure. This assumption and analysis are based solely on the pesticide decay results and implicitly assume that there are no other biological factors (such as pest population growth of new target areas on the plants), which would require an 18-day interval to be maintained. Furthermore, study results suggest that the electrostatic application could potentially allow a 30 - 50% reduction in applied myclobutanil and continued use of the 18-day application intervals with essentially no increase in DFR levels.

Conclusions

Although the results did not reach statistical significance, and all the study sites showed different results on initial pesticide deposition, initial deposition outside the canopy with EFR was twice the deposition obtained with CFR and EHR. Furthermore, when results were averaged for inside and outside the canopy and for all sites, they showed that the EFR resulted in the highest foliar deposition. CFR attained 68% of the EFR deposition. The EHR was equivalent to half the EFR deposition and achieved approximately 70% of the deposition obtained with CFR. However inside the canopy, EFR and CFR gave similar deposition and EHR was half of the EFR and CFR deposition.

Reduced-volume techniques characteristically use smaller, more concentrated droplets, and the addition of spray charging has been shown to alter the spatial distribution of foliar spray deposit. However, most of the droplets are deposited on the outside of the canopy. Such characteristics could affect the transfer factor, and the effects should be investigated.

The application method had no effect on pesticide dissipation rate. However, canopy location had a significant effect, indicating shorter decay on the outside grape foliage (by 2.3 to 3.4 fold), than those inside the canopy given the greater protection from ultra-violet light. More work needs to be done to understand the impact of these effects on worker exposure and should be considered while investigating pesticide illnesses.

In recent years, grape acreage has increased in California and numerous trellis systems have been incorporated changing the canopy structure and its management thus making cultural activities on grapes more intensive than in the past. Pesticide deposition is also affected by canopy density and we need a better understanding of pesticide deposition under these various trellis systems. Furthermore, the distance of the nozzles from the canopy does affect the deposition. In this study the highest deposition was obtained on the lightest canopy as seen at the beginning of the growing season and regardless of the application system. Differences were observed for the EFR and CFR system when dealing with medium and high canopy density coupled with the different trellis system. The electrostatic application attained the lowest deposition among the densest canopy (on both canopy locations and when averaging over location), regardless of the trellis system.

Results based on predicted mean myclobutanil DFR suggest a reduction on pesticide application rate and/or reduction of the number of myclobutanil applications per growing season with the use of electrostatic full rate application.

In any view of future pesticide application needs, the appropriate chemical would be applied according to foliage densities, type of pest, and pest potentials and locations. This study only presents the effects of two technologies on initial deposition and decay of myclobutanil. Efficacy tests were not part of the study, yet they are another important component on an application and economic end result that should not be disregarded.

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APPENDICES

Appendix 1. Time spent on actual application per pass (row).

Site 1

Electrostatic Half Rate			Electrostatic Full Rate			Conventional Full Rate		
Pass No.	**Direction**	**Pass Time (sec)**	**Pass No.**	**Direction**	**Pass Time (sec)**	**Pass No.**	**Direction**	**Pass Time (sec)**
1	W⇒ E	400	1	W⇒ E	321	1	W⇒ E	363
2	E ⇒ W	380	2	E ⇒ W	366	2	E ⇒ W	366
3	W⇒ E	378	3	W⇒ E	369	3	W⇒ E	256
4	E ⇒ W	376	4	E ⇒ W	368	4	E ⇒ W	nt
						5	W⇒ E	nt
						6	E ⇒ W	nt
						7	W⇒ E	nt
						8	E ⇒ W	nt
						9	W⇒ E	nt

Average/Pass . 6 min. & 24 sec. 5 min. & 56 sec. 5 min. & 28 sec.
Avg. Time/Acre 8 min. & 1 sec. 7 min & 26 sec . 15 min & 25 sec.
nt = no time recorded

Site 2

Electrostatic Half Rate			Electrostatic Full Rate			Conventional Full Rate		
Pass No.	**Direction**	**Pass Time (sec)**	**Pass No.**	**Direction**	**Pass Time (sec)**	**Pass No.**	**Direction**	**Pass Time (sec)**
1	W⇒ E	355	1	W⇒ E	480	1	W⇒ E	nt
2	E ⇒ W	nt	2	E ⇒ W	367	2	E ⇒ W	nt
3	W⇒ E	nt	3	W⇒ E	480	3	W⇒ E	nt
						4	E ⇒ W	nt
						5	W⇒ E	nt
						6	E ⇒ W	nt
						7	W⇒ E	nt
						8	E ⇒ W	nt
						9	W⇒ E	nt

Average/Pass 5 min. & 55 sec. 7 min. & 22 sec.
Avg. Time/Acre 5 min. & 32 sec. 6 min & 55 sec.
nt = no time recorded

Appendix 1. Time spent on actual application per pass (con't).

Site 3

Electrostatic Half Rate			Electrostatic Full Rate			Conventional Full Rate		
Pass No.	Direction	Pass Time (sec)	Pass No.	Direction	Pass Time (sec)	Pass No.	Direction	Pass Time (sec)
1	E ⇒ W	205	1	E ⇒ W	185	1	E ⇒ W	202
2	W⇒ E	202	2	W⇒ E	188	2	W⇒ E	164
3	E ⇒ W	200	3	E ⇒ W	192	3	E ⇒ W	170
4	W ⇒ E	206	4	W ⇒ E	189	4	W ⇒ E	167
						5	E ⇒ W	179
						6	W ⇒ E	174
						7	E ⇒ W	172
						8	W ⇒ E	168
						9	E ⇒ W	175

Average/Pass 3 min. & 23 sec. 2 min. & 59 sec. 2 min. & 55 sec.
Avg. Time/Acre 8 min. & 28 sec. 7 min & 51 sec. 16 min. & 22 sec.
nt = no time recorded

Site 4

Electrostatic Half Rate			Electrostatic Full Rate			Conventional Full Rate		
Pass No.	Direction	Pass Time (sec)	Pass No.	Direction	Pass Time (sec)	Pass No.	Direction	Pass Time (sec)
1	E ⇒ W	107	1	E ⇒ W	103	1	E ⇒ W	100
2	W⇒ E	102	2	W⇒ E	103	2	W⇒ E	103
3	E ⇒ W	100	3	E ⇒ W	102	3	E ⇒ W	96
4	W⇒ E	106	4	W⇒ E	104	4	W⇒ E	102
						5	E ⇒ W	102
						6	W⇒ E	100
						7	E ⇒ W	96
						8	W ⇒ E	101
						9	E ⇒ W	98

Average/Pass 1 min. & 44 sec. 1 min. & 43 sec. 1 min. & 40 sec.
Avg. Time/Acre 6 min. & 28 sec. 6 min & 25 sec. 14 min.
nt = no time recorded

Site 5

Electrostatic Half Rate			Electrostatic Full Rate			Conventional Full Rate		
Pass No.	Direction	Pass Time (sec)	Pass No.	Direction	Pass Time (sec)	Pass No.	Direction	Pass Time (sec)
1	W ⇒ E	322	1	W ⇒ E	322	1	W ⇒ E	340
2	E ⇒ W	322	2	E ⇒ W	322	2	E ⇒ W	342
3	W ⇒ E	321	3	W ⇒ E	321	3	W ⇒ E	351
						4	E ⇒ W	360
						5	W ⇒ E	341
						6	E ⇒ W	356
						7	W ⇒ E	357
						8	E ⇒ W	356
						9	W ⇒ E	351

Average/Pass 5 min. & 22 sec. 5 min. & 22sec. 5 min. & 50 sec
Avg. Time/Acre 4 min. & 29 sec. 4 min & 29 sec. 16 min. & 29sec
nt = no time recorded

Appendix 2. Dislodgeable foliar residue (DFR) raw data - µg/sample.

Site 1

		TREATMENT							
		CONTROL	CONTROL	EHR	EHR	EFR	EFR	CFR	CFR
Interval	Sample	IN	OUT	IN	OUT	IN	OUT	IN	OUT
0	A	*	*	38.9	29.5	57.2	28.2	71.7	ND
0	B	*	*	42.9	32.2	65.7	20.9	46.9	10.5
0	C	*	*	26.3	14.2	**	**	**	**
0	D	*	*	**	**	**	**	**	**
1	A	*	*	62.4	79.2	131	157	125	22.1
1	B	*	*	43.8	101	135	111	112	20
1	C	*	*	115	86.5	261	100	125	25.2
1	D	*	*	112	83.1	209	115	135	31.7
3	A	*	*	65.9	35.8	153	173	96.9	31.5
3	B	*	*	59.5	78.8	126	166	105	28.3
3	C	*	*	101	64.7	224	165	113	52.5
3	D	*	*	128	80.3	234	147	96.7	58.9
7	A	*	*	87.9	57.4	155	93.3	101	ND
7	B	*	*	82.8	46.4	174	54.5	112	ND
7	C	*	*	71.7	65.9	120	85.2	110	13.7
7	D	*	*	97.6	60.2	200	87.6	105	13.7
14	A	*	*	71.4	58.9	99	149	58.1	19.1
14	B	*	*	56.4	59.5	108	122	76.6	17.6
14	C	*	*	48.5	60.9	113	102	70.4	32.2
14	D	*	*	57.2	57.4	143	111	61.3	25.2
19	A	*	*	63.6	11.6	106	51	75.1	ND
19	B	*	*	46.4	13.2	102	44.2	67.1	ND
19	C	*	*	63.5	12.8	185	58.8	83.3	ND
19	D	*	*	62.6	16.1	109	44.2	71.5	ND
26	A	*	*	43.2	ND	58.7	36.5	46.4	ND
26	B	*	*	40.3	ND	89.8	55.1	32.1	15.4
26	C	*	*	54.5	ND	100	26.4	49.6	ND
26	D	*	*	64.4	ND	74.7	28.5	33.6	10.8

Site 2

0 A	ND	ND	ND	ND	ND	ND	ND	ND
0 B	ND	ND	ND	ND	ND	ND	ND	ND
0 C	***	ND	ND	ND	ND	ND	ND	ND
0 D	ND	***	ND	ND	ND	ND	ND	ND
1 A	15.9	67.4	86.4	42.3	35	87.8	22.7	44.8
1 B	22.4	66	71.4	66.9	53.8	85.7	28	81.2
1 C	47.8	108	82.6	71.1	35.9	69.5	16.8	38.8
1 D	48.9	132	71.8	81.1	32.1	87.5	39.1	83.3

Appendix 2. Dislodgeable foliar residue (DFR) raw data - µg/sample (con't).

Site 2 (con't).

		TREATMENT							
		CONTROL	CONTROL	EHR	EHR	EFR	EFR	CFR	CFR
Interval	Sample	IN	OUT	IN	OUT	IN	OUT	IN	OUT
3	A	ND	ND	14.4	29.6	26.9	49.2	87.2	38.5
3	B	ND	ND	14.8	50.0	35.6	61.0	72.9	61.2
3	C	ND	ND	10.0	27.4	21.7	56.8	74.3	69.1
3	D	ND	ND	18.9	39.9	62.2	67.9	77	88.2
8	A	ND	ND	11.5	34.1	21.7	52.8	66.2	30.3
8	B	ND	ND	14.1	36.3	28.3	69.9	64.2	28.3
8	C	ND	ND	16.3	35.2	18.9	43.1	74.8	41.8
8	D	ND	ND	20.3	19.4	25.1	52.6	70	29
14	A	ND	ND	ND	ND	ND	ND	36.9	17.3
14	B	ND	ND	13.6	ND	ND	ND	31.1	18.6
14	C	ND	ND	ND	14.6	ND	ND	43.2	27.4
14	D	ND	ND	13.2	10.1	ND	ND	39.5	19.4
21	A	ND	ND	ND	ND	11.1	ND	31.2	14.2
21	B	ND	ND	ND	ND	17.8	12.3	35	13.2
21	C	ND	ND	ND	ND	14.3	ND	31.1	14.1
21	D	ND	ND	14.1	ND	19.6	14.4	36.5	19

Site 3

0	A	***	***	ND	2.03	***	***	***	***
0	B	***	***	2.71	4.95	***	***	***	***
0	C	***	***	ND	4.15	***	***	***	***
0	D	***	***	ND	***	***	***	***	***
0.5	A	ND	ND	49.9	56.4	48.2	133	93.2	123
0.5	B	**	**	35.5	60.5	55.6	168	104	120
0.5	C	**	**	71	84.8	151	135	103	101
0.5	D	**	**	49.9	83.6	137	139	94.8	106
2.5	A	ND	ND	40.1	59.6	47.5	131	80.8	86.1
2.5	B	**	**	34.1	52.7	47	112	82.7	84.9
2.5	C	**	**	50.1	56	104	91.4	90.9	72.6
2.5	D	**	**	46.7	65.1	114	119	87.6	60.2
7.5	A	ND	ND	30.9	60.8	48.9	100	89.3	67.7
7.5	B	**	**	31.5	37.1	52.1	90.7	76.5	58.5
7.5	C	**	**	54.9	51.4	186	76.2	73.2	41.3
7.5	D	**	**	61.8	56.5	149	86.4	80.9	43
13.5	A	ND	ND	27.8	14.5	38.5	48.8	62.6	38.1
13.5	B	**	**	22.2	19.4	48.7	59.8	70.9	38.1
13.5	C	**	**	45.1	22.4	134	48.8	70	23.1
13.5	D	**	**	46.1	23.5	168	37.6	68.6	27.4
16.5	A	ND	ND	19.2	17.7	45	60.6	59.4	34.9
16.5	B	**	**	22.7	22.9	45.3	36.6	73.7	30.7
16.5	C	**	**	59.5	23.7	155	42.1	59	19.9
16.5	D	**	**	39	24.7	137	31.7	59.3	22.1

Appendix 2. Dislodgeable foliar residue (DFR) raw data - µg/sample (con't).

Site 4

		TREATMENT							
		CONTROL	CONTROL	EHR	EHR	EFR	EFR	CFR	CFR
Interval	Sample	IN	OUT	IN	OUT	IN	OUT	IN	OUT
0	A	ND	ND	20.4	ND	66	8.73	21.6	2.5
0	B	**	**	24.3	ND	102	8.53	23.4	3.89
0	C	**	**	ND	17	51	12.9	32.7	7
0	D	**	**	18.8	3.7	58.8	10.3	28.5	8.77
1	A	ND	ND	28.1	25.1	83.4	77.8	84	46
1	B	**	**	33.9	37.6	91.9	72.3	80.9	54.4
1	C	**	**	23.3	39.2	72	67	89.3	50.4
1	D	**	**	30	31.3	72	57.3	83.8	45.9
3	A	ND	ND	25.4	17.1	65.4	58.6	72.3	36.6
3	B	**	**	32.5	25.6	73.3	54.1	72.3	33.5
3	C	**	**	24.2	23.2	60.8	50	72.5	35.1
3	D	**	**	16.7	22	63.5	43.5	77.9	36.3
7	A	ND	ND	16.1	4.06	30.8	40	44.7	6.7
7	B	**	**	26.8	12.1	54.8	8.1	52.6	10.1
7	C	**	**	19.6	10.8	42.3	9.1	44.1	7.57
7	D	**	**	9.6	5.8	41.3	14.2	51	9.96
14	A	ND	ND	14.9	2.6	36.2	10	41.2	9.09
14	B	**	**	18.4	3.03	62	12	39.9	9.67
14	C	**	**	17.4	2.64	54.9	13.1	42.9	9.06
14	D	**	**	18.3	4.88	56.7	9.1	39.8	9.73

Site 5

0	A	ND	ND	32.2	8.02	51.2	17.9	50.8	6.3
0	B	ND	ND	33.2	8.01	62.8	15.3	65	ND
0	C	**	**	35.8	11.4	27.1	25.3	66.1	3.97
0	D	**	**	24.5	8.7	50.7	18.4	33.9	ND
1	A	ND	ND	69.1	37	110	124	121	47.2
1	B	ND	ND	63	43.7	118	125	117	34
1	C	**	**	85.9	51.7	128	124	88	41.3
1	D	**	**	48.7	32.8	115	131	101	48.1
3	A	ND	ND	43	31.6	82.1	98.6	95	21.4
3	B	ND	ND	51.7	33.4	81.5	123	117	12.4
3	C	**	**	69.2	37.1	103	66.4	77.6	20.7
3	D	**	**	57.2	41.8	131	97.6	89.1	20.5
7	A	ND	ND	37	17.8	45.4	41.5	94.6	15.2
7	B	ND	ND	42.2	18.7	82	61.4	93.6	13
7	C	**	**	68.4	16.5	111	65.8	73.9	19.1
7	D	**	**	55.5	17	129	40.7	58.6	12.1
14	A	ND	ND	32	7.32	76.8	40.1	83.1	11.5
14	B	ND	ND	33.4	10.7	56.7	40.1	83	9.23
14	C	**	**	51.5	11.7	92.4	33.7	57	8.95
14	D	**	**	36	10.9	97.5	28.9	72.3	10.1

Appendix 2. Dislodgeable foliar residue (DFR) raw data - µg/sample (con't).

Site 5 (con't).

		TREATMENT							
		CONTROL	CONTROL	EHR	EHR	EFR	EFR	CFR	CFR
Interval	Sample	IN	OUT	IN	OUT	IN	OUT	IN	OUT
21	A	ND	ND	21.6	4.71	57	15.4	53.7	9.11
21	B	ND	ND	25.9	5.32	68.3	10.7	70.3	4.13
21	C	**	**	33.4	6.94	66.4	14.3	48.1	5.28
21	D	**	**	32.7	4.36	72.7	14.7	36.2	5.31

Rep. = replicate
0 = presample (before application)
*No control plot per grower request
**No sample collected
***Samples re-directed
Interval = Days after pesticide application

EHR = Electrostatic Half Rate
EFR = Electrostatic Half Rate
CFR = Conventional Full Rate
IN = Inside the canopy
OUT = Outside the canopy
ND = None detected

Appendix 3. Myclobutanil exponential regression for dislodgeable foliar residue on grapes.

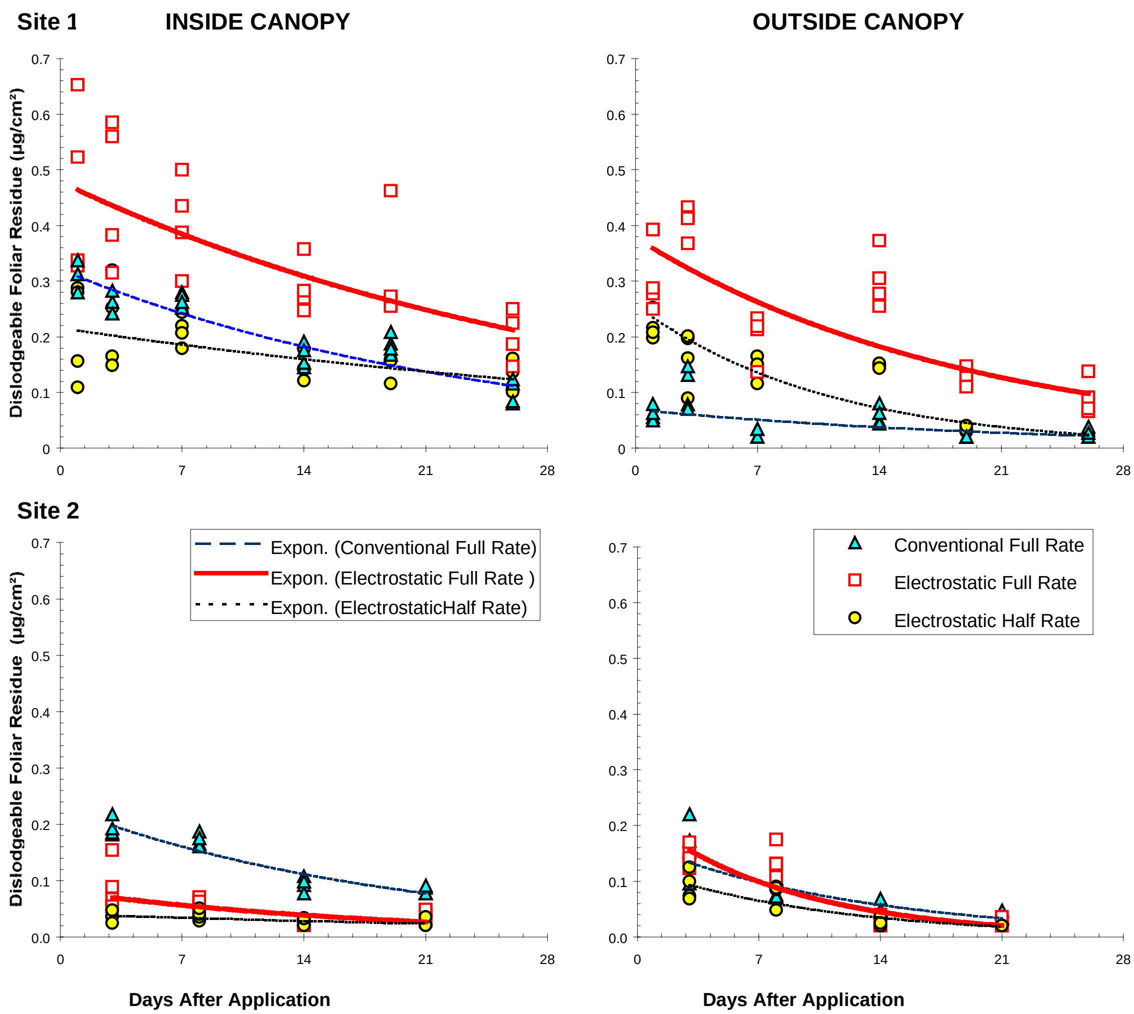

Fig. 3 - 1. Full-rate electrostatic (4 oz per acre in 8 - 10 gal.), conventional (4 oz per acre in 80 - 100 gal.), and one-half rate electrostatic application (2 oz per acre in 8 - 10 gal.). Entries are four samples for each application and location within the canopy (inside and outside) - 1996.

Appendix 3. Myclobutanil exponential regression for dislodgeable foliar residue on grapes (con't).

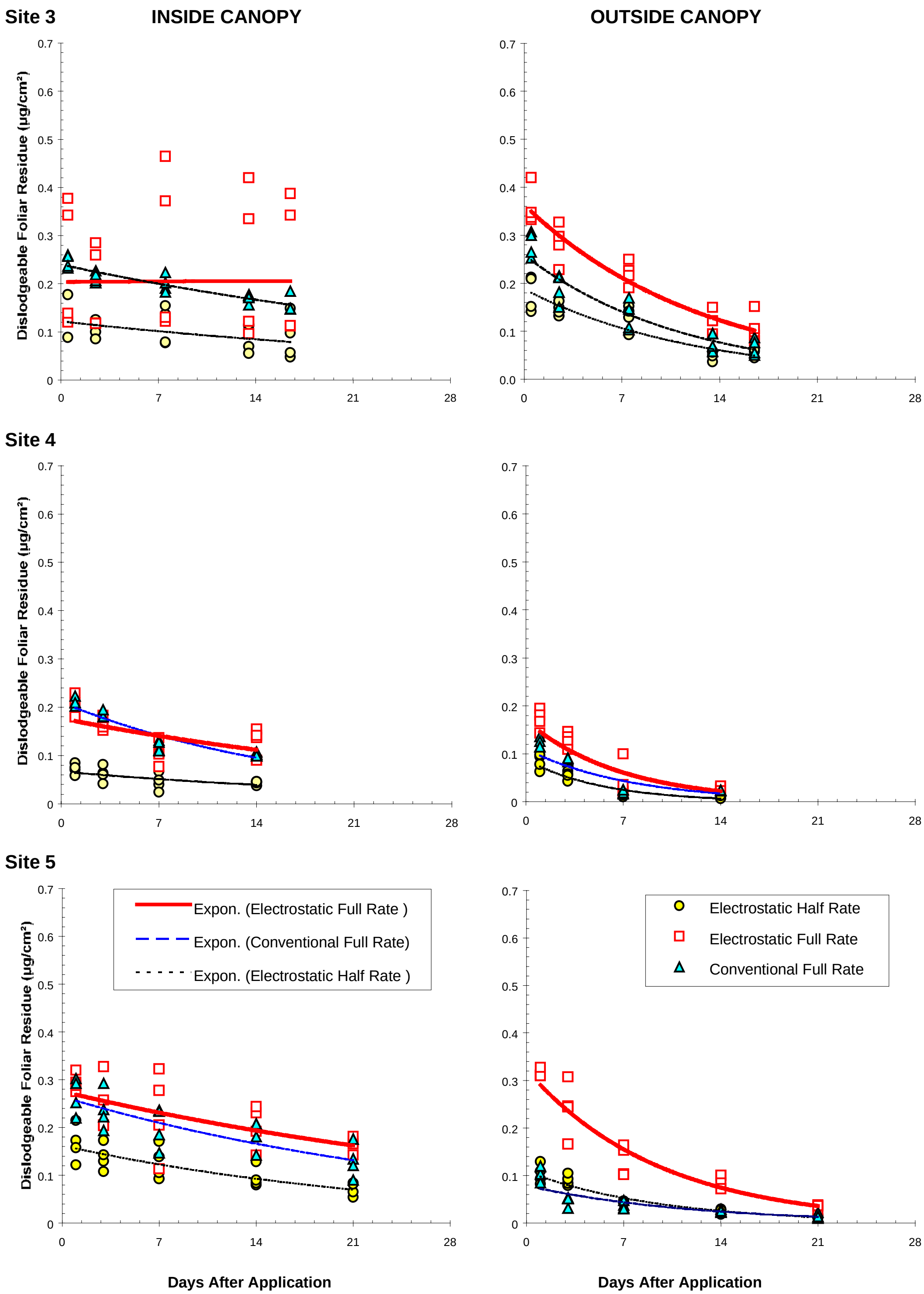

Fig. 3 - 2. Full-rate electrostatic (4 oz per acre in 10 gal.), conventional (4 oz per acre in 100 gal.), and one-half rate electrostatic application (2 oz per acre in 10 gal.). Entries are four samples for each application and location within the canopy (inside and outside) - 1997.

Appendix 3. Myclobutanil exponential regression for dislodgeable foliar residue on grapes (con't).

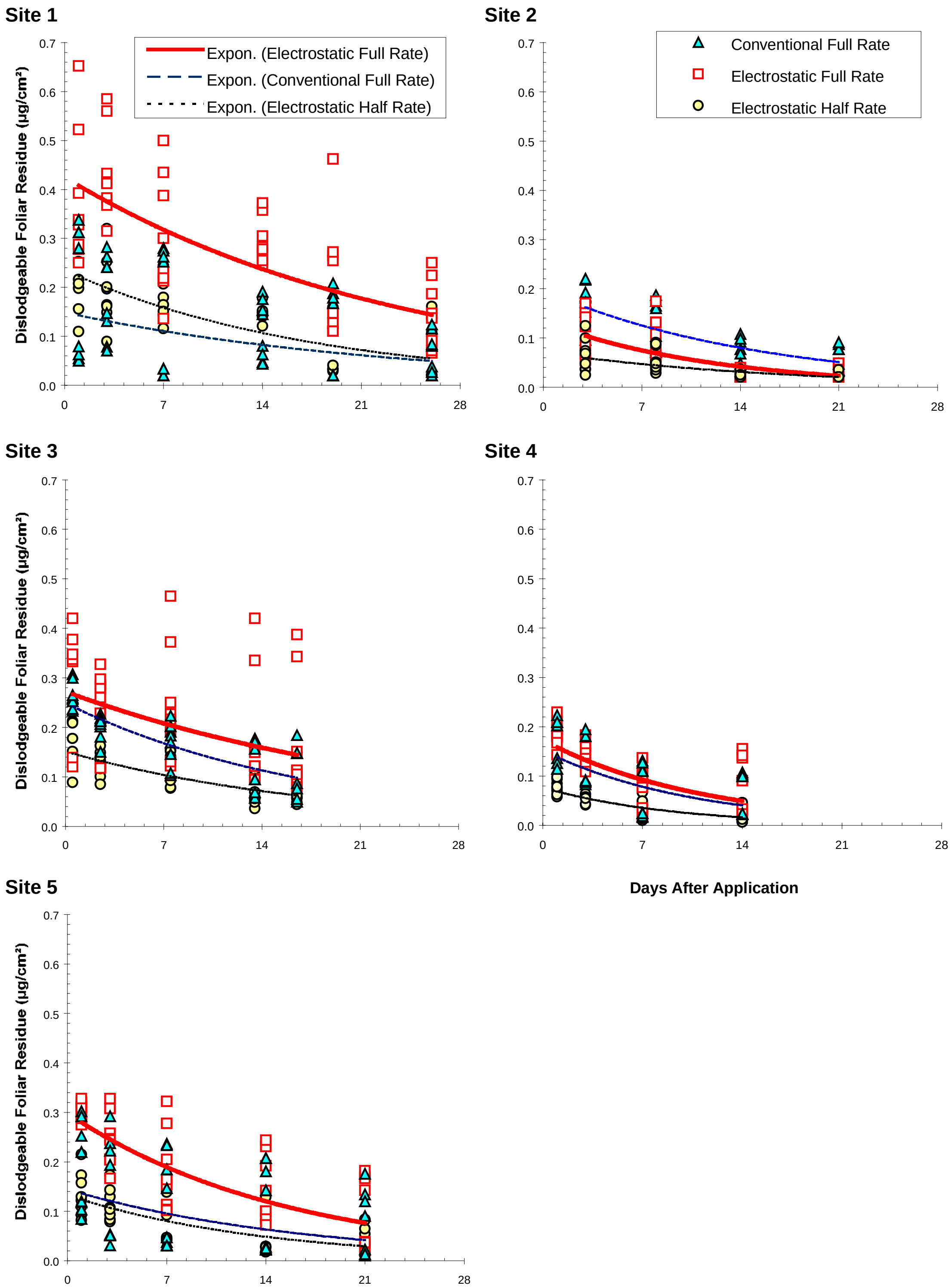

Fig.3 - 3. Full-rate electrostatic (4 oz per acre in 8 - 10 gal.), conventional (4 oz per acre in 80 - 100 gal.), and one-half rate electrostatic application (2 oz per acre in 8 - 10 gal.). Entries for each application are four samples each for inside and outside canopy location.

Appendix 4. Hourly meteorological summaries.

Table 4-1. University of California Cooperative Extension - San Joaquin Valley
Station: Lodi
Site 1

Date		AIR			DEW	RELATIVE HUMIDITY	WIND			
Date (mm/dd/yy)	Time	Temp (°C)	Temp Min (°C)	Time (PST)	Pt (°C)	(%)	Average Direction	Speed (m/s)	Gust (m/s)	Precipitation (inches)
7/18/96	3:00	11.7	10.7	3:00	10.7	93	SW	0.0	0.5	0.00
7/18/96	4:00	10.7	10.3	3:43	9.9	95	SW	0.0	0.9	0.00
7/18/96	5:00	10.9	10.3	4:44	10.3	96	SW	0.1	1.5	0.00
7/18/96	6:00	11.7	10.3	4:44	10.6	96	SW	0.0	0.5	0.00
7/18/96	7:00	14.7	10.3	4:44	13.2	91	SW	0.3	2.1	0.00
7/18/96	8:00	18.2	10.3	4:44	13.4	74	SW	1.3	3.6	0.00
7/18/96	9:00	21.1	10.3	4:44	13.9	64	SW	1.7	3.6	0.00
Average		14.1			11.7	87	SW	0.5	1.8	
Maximum		21.1			13.9	96		1.7	3.6	
Minimum		10.7			9.9	64		0.0	0.5	

(m/s) = meters per second

Table 4-2. University of California Cooperative Extension - San Joaquin Valley
Station: Lodi
Site 2

Date		AIR			DEW	RELATIVE HUMIDITY	WIND			
Date (mm/dd/yy)	Time	Temp (°C)	Temp Min (°C)	Time (PST)	Pt (°C)	(%)	Average Direction	Speed (m/s)	Gust (m/s)	Precipitation (inches)
7/30/96	4:00	17.7	17.3	3:29	13.5	77	E	0.0	0.0	0.00
7/30/96	5:00	17.3	16.9	4:59	13.1	76	ENE	0.0	0.3	0.00
7/30/96	6:00	17.9	16.5	5:12	13.8	77	W	0.0	0.4	0.00
7/30/96	7:00	22.1	16.5	5:12	13.1	57	W	0.4	1.5	0.00
7/30/96	8:00	23.9	16.5	5:12	13.9	53	W	0.6	2.1	0.00
7/30/96	9:00	26.2	16.5	5:12	15.2	50	W	1.0	2.2	0.00
Average		20.8			13.8	65	WNW	0.3	1.1	
Maximum		26.2			15.2	77		1.0	2.2	
Minimum		17.3			13.1	50		0.0	0.0	

(m/s) = meters per second

Appendix 4. Hourly meteorological summaries (con't).
Table 4-3. CIMIS - San Joaquin County
Station 42

Site #	Date (yy/mm/dd)	Time (PST)	SOIL Temp. (°C)	AIR Temp. (°C)	RELATIVE HUMIDITY (Avg. %)	DEW Pt. (°C)	WIND Speed (m/s)	WIND Result (m/s)	WIND Direction (0-360 dg)	WIND Direction
SITE 3										
	97-05-05	19:00	19.50	21.66	41.43	8.003	3.535	3.443	268.6	W
	97-05-05	20:00	19.46	18.53	52.11	8.528	2.968	2.878	266.2	W
	97-05-05	21:00	19.40	17.41	58.48	9.192	2.414	2.312	258.5	SW
	97-05-05	22:00	19.32	16.69	66.11	10.337	1.880	1.810	239.2	SW
	97-05-05	23:00	19.23	17.69	47.18	6.304	2.715	2.508	257.7	SW
	97-05-05	23:59	19.15	16.53	54.13	7.233	1.242	1.090	236.0	SW
SITE 4										
	97-06-09	4:00	22.03	13.05	94.43	12.177	0.477	0.403	107.5	E
	97-06-09	5:00	21.92	12.46	95.73	11.798	0.448	0.099	249.1	W
	97-06-09	6:00	21.82	13.95	94.64	13.104	0.503	0.294	254.4	W
	97-06-09	7:00	21.71	16.39	83.58	13.604	1.133	0.913	295.7	NW
	97-06-09	8:00	21.64	18.19	77.94	14.281	1.357	0.986	296.7	NW
	97-06-09	9:00	21.61	19.79	73.22	14.860	1.738	1.406	256.9	W

(m/s) = meters per second
Location: Latitude 38 degree, 6 min, 34 sec.
Longitude 121degree, 20min, 46sec.
Township 3N, Range 6E, Sect 17
Address: De Vries & Kingdom

Table 4-4. University of California Cooperative Extension – San Joaquin Valley
Station: Lodi
Site 5

Date mm/dd/yy	Time	AIR Temp. (°C)	AIR Temp. Min (°C)	Time (PST)	DEW Pt (°C)	RELATIVE HUMIDITY (%)	WIND Average Direction	WIND Speed (m/s)	WIND Gust (m/s)	Precipitation (inches)
7/8/97	3:00	15.6	15.3	2:50	14.1	91	E	0.0	0.7	0.00
7/8/97	4:00	15.7	15.3	2:50	13.7	88	E	0.0	0.0	0.00
7/8/97	5:00	14.8	14.1	4:58	13.1	89	E	0.0	0.0	0.00
7/8/97	6:00	15.7	14.1	4:58	14.3	91	E	0.0	0.0	0.00
7/8/97	7:00	21.0	14.1	4:58	15.2	70	WSW	0.1	1.4	0.00
7/8/97	8:00	22.7	14.1	4:58	15.3	63	W	0.7	2.6	0.00
7/8/97	9:00	25.2	14.1	4:58	16.8	59	W	0.7	2.0	0.00
Average		18.7			14.6	79	E	0.2	0.9	
Maximum		25.2			16.8	91		0.7	2.6	
Minimum		14.7			13.1	59		0.0	0.0	

(m/s) = meters per second
Location: Chardonnay block (Site 1 & 5, Acampo)

Appendix 5. Daily meteorological summaries.
CIMIS San Joaquin County
Station 42 - 1996

Station	Date	TEMPERATURE			Precipitation	RELATIVE HUMIDITY	
		Max.	Min.	Avg.		Max.	Min.
#	(yy/mm/dd)	(°C)	(°C)	(°C)	(mm)	(%)	(%)
42	96-07-18	29.87	10.51	20.51	0	100	28.75
42	96-07-19	32.45	11.04	22.22	0	90.209	19.57
42	96-07-20	35.14	11.72	24.58	0	88.507	23.23
42	96-07-21	37.13	13.69	26.01	0	87.604	16.647
42	96-07-22	33.75	13.31	24.02	0	82.744	20.479
42	96-07-23	33.31	15.32	24.05	0	83.277	23.28
42	96-07-24	33.45	13.83	23.47	0	87.008	20.682
42	96-07-25	35.8	14.34	24.36	0	91.831	35.745
42	96-07-26	32.07	14.33	22.62	0	89.164	33.827
42	96-07-27	32.01	15.57	24.08	0	89.91	37.558
42	96-07-28	35.99	18.45	27.09	0	67.038	32.284
42	96-07-29	37.65	17.92	27.52	0	73.399	32.137
42	96-07-30	36.67	17.97	26.97	0	70.504	32.225
42	96-07-31	37.78	17.11	27.22	0	78.686	20.03
42	96-08-01	31.36	13.02	22.38	0	90.525	33.322
42	96-08-02	33.94	11.96	22.41	0	92.249	21.031
42	96-08-03	29.76	12.45	21.31	0	88.252	34.859
42	96-08-04	32.69	13.5	22.54	0	87.033	29.157
42	96-08-05	27.65	12.04	19.26	0	93.196	38.145
42	96-08-06	29.26	F	22.81	0	100	36.301
42	96-08-07	31.99	11.37	21.27	0	100	27.118
42	96-08-08	35.05	13.11	23.78	0	92.663	34.85
42	96-08-09	38.04	15.63	26.39	0	83.598	26.372
42	96-08-10	38.61	17.48	27.2	0	57.762	22.141
42	96-08-11	38.19	20.01	28.3	0	57.706	25.955
42	96-08-12	38.35	18.09	27.51	0	80.059	24.939
42	96-08-13	38.06	19.66	28.16	0	75.378	25.741
42	96-08-14	36.54	17.45	26.58	0	70.689	17.563
42	96-08-15	36.15	12.85	24.49	0	89.882	12.902
42	96-08-16	35.57	11.77	22.91	0	90.543	19.091
42	96-08-17	28.83	12.09	19.77	0	98.15	41.993
42	96-08-18	29.37	10.42	19.68	0	91.185	35.024
42	96-08-19	26.84	10.14	17.77	0	96.119	36.673
42	96-08-20	28.49	7.61	18.37	0	100	38.95

Appendix 5. Daily meteorological summaries (con't).

Station 42 - 1997

Station #	Date (yy/mm/dd)	TEMPERATURE Max. (°C)	Min. (°C)	Avg. (°C)	Precipitation (mm)	RELATIVE HUMIDITY Max. (%)	Min. (%)
42	97-05-05	27.75	7.80	18.39	0	94.829	16.038
42	97-05-06	28.66	12.70	20.62	0	69.908	24.736
42	97-05-07	30.00	10.15	20.00	0	89.136	22.255
42	97-05-08	29.02	7.78	18.13	0	94.108	28.027
42	97-05-09	31.13	8.48	19.65	0	96.118	26.862
42	97-05-10	30.26	9.78	19.77	0	93.864	30.660
42	97-05-11	30.09	11.75	19.92	0	93.999	29.667
42	97-05-12	32.84	13.08	21.78	0	86.076	18.937
42	97-05-13	30.55	11.00	21.37	0	81.076	19.638
42	97-05-14	30.13	12.82	22.12	0	92.134	38.814
42	97-05-15	30.70	13.28	22.75	0	88.808	31.855
42	97-05-16	34.24	12.78	23.97	0	92.828	25.406
42	97-05-17	35.62	15.04	26.08	0	88.480	15.291
42	97-05-18	36.25	16.06	25.61	0	85.732	17.295
42	97-05-19	32.64	13.49	22.88	0	76.423	15.707
42	97-05-20	25.88	11.03	18.75	0	88.203	40.284
42	97-05-21	28.91	8.48	19.07	0	98.112	18.933
42	97-05-22	26.71	10.43	18.68	0	79.558	21.205
42	97-05-23	23.13	13.58	17.20	9	98.437	60.381
42	97-05-24	25.09	10.05	17.80	0	95.370	39.780
42	97-05-25	26.08	8.22	17.17	0	95.839	32.383
42	97-06-03	20.93	15.35	17.65	4	99.385	72.205
42	97-06-04	24.88	12.85	18.83	0	100.000	40.583
42	97-06-05	26.98	11.99	19.61	1	95.209	39.065
42	97-06-06	31.39	13.95	23.17	0	81.000	20.350
42	97-06-07	31.59	13.94	22.80	1	84.662	32.951
42	97-06-08	28.82	12.63	20.39	0	93.858	42.692
42	97-06-09	29.22	12.25	20.28	2	95.734	37.232
42	97-06-10	28.09	F	20.91	0	92.469	42.924
42	97-06-11	27.91	11.41	19.36	0	96.950	38.352
42	97-06-12	26.05	12.26	18.34	0	95.983	32.981
42	97-06-13	28.88	13.54	21.37	0	89.595	32.621
42	97-06-14	30.44	14.06	22.21	0	83.902	37.180
42	97-06-15	30.08	14.84	21.32	0	89.547	43.020
42	97-06-16	33.69	13.22	23.14	0	95.969	38.764
42	97-06-17	30.57	13.86	23.02	0	91.471	37.888
42	97-06-18	32.89	14.48	23.60	0	90.014	23.957
42	97-06-19	34.19	12.92	23.66	0	91.444	27.920
42	97-06-20	30.29	11.79	21.12	0	83.466	28.353
42	97-06-21	29.01	11.36	19.47	0	87.056	28.230
42	97-06-22	27.82	10.28	19.01	0	90.693	33.580
42	97-06-23	30.13	10.72	21.13	0	83.804	16.216

Appendix 5. Daily meteorological summaries (con't).

Station 42 - 1997

		TEMPERATURE				RELATIVE HUMIDITY	
Station #	Date yy/mm/dd	Max. (°C)	Min. (°C)	Avg. (°C)	Precipitation (mm)	Max. (%)	Min. (%)
42	97-07-08	36.65	15.19	26.52	0	89.766	26.529
42	97-07-09	32.85	16.04	24.61	0	84.205	37.755
42	97-07-10	30.88	13.05	21.51	0	92.986	36.752
42	97-07-11	31.38	12.36	21.33	0	86.255	31.421
42	97-07-12	32.11	11.27	21.18	0	98.528	34.333
42	97-07-13	31.91	13.28	22.47	0	95.495	34.788
42	97-07-14	32.33	13.20	22.30	0	93.613	27.464
42	97-07-15	34.51	12.73	23.15	0	95.505	20.855
42	97-07-16	27.80	13.84	21.17	0	93.230	47.525
42	97-07-17	31.06	13.93	21.77	0	94.174	29.150
42	97-07-18	32.21	11.39	21.88	0	94.337	28.967
42	97-07-19	33.71	14.12	23.65	0	89.252	33.925
42	97-07-20	31.07	12.92	21.68	0	97.776	41.260
42	97-07-21	34.10	12.77	23.18	0	98.529	27.023
42	97-07-22	32.59	14.57	22.81	0	89.041	27.596
42	97-07-23	28.47	15.52	21.02	0	87.013	50.334
42	97-07-24	33.85	16.44	25.03	0	91.372	30.498
42	97-07-25	34.70	0.00	28.18	0	75.508	25.051
42	97-07-26	32.06	13.86	22.42	0	89.253	30.539
42	97-07-27	30.41	12.97	20.64	0	96.986	35.887
42	97-07-28	31.54	11.92	21.09	0	97.480	32.502
42	97-07-29	29.73	0.00	23.57	0	96.319	40.460
42	97-07-30	28.72	12.86	19.71	0	98.620	40.837
42	97-07-31	31.09	10.29	20.24	0	97.360	25.773
42	97-08-01	32.03	11.28	21.27	0	92.873	24.592
42	97-08-02	33.75	12.04	22.69	0	89.759	24.629
42	97-08-03	34.43	11.50	22.90	0	93.301	21.083
42	97-08-04	36.28	13.12	24.75	0	87.129	16.989
42	97-08-05	38.92	14.51	26.64	0	84.551	15.992
42	97-08-06	38.48	15.04	26.72	0	89.300	21.561
42	97-08-07	38.42	16.90	27.15	0	90.436	18.530

F = flagged data: fallen outside QC and statistically an interval that has fallen outside a mean.
In general is associated with gusty winds, cooler, and rainy days.

Location: Latitude 38 degree, 6 min, 34 sec.
Longitude 121 degree, 20min., 46sec.

Township: 3N, Range 6E, Sect. 17.

Address: De Vries & Kingdom

Appendix 6. Tank mix and nozzle sample analysis.

Site 1-Tank

Equipment	Chemical	Rate		Tank			
		oz/acre	oz ai/acre	%	g ai./L	oz ai./gal	oz ai/gal/acre
Electrostatic	Rally 40W	2	0.8	0.0660	0.66	0.0878	0.7027 oz ai/8gal
Electrostatic	Rally 40W	4	1.6	0.1280	1.28	0.1704	1.3629 oz ai/8gal
Conventional	Rally 40W	4	1.6	0.0160	0.16	0.0213	1.7036 oz ai/80gal

Site 1-Nozzle

Equipment	Chemical	Rate		Nozzle			
		oz/acre	oz ai/acre	%	g ai/L	oz ai/gal	oz a.i/gal/acre
Electrostatic	Rally 40W	2	0.8	0.0680	0.68	0.0905	0.7240 oz ai/8gal
Electrostatic	Rally 40W	4	1.6	0.1280	1.28	0.1704	1.3629 oz ai/8gal
Conventional	Rally 40W	4	1.6	0.0150	0.15	0.01996	1.5971 oz ai/80gal

Site 2-Tank

Equipment	Chemical	Rate		Tank			
		oz/acre	oz ai/acre	%	g ai/L	oz ai/gal	oz ai/gal/acre
Electrostatic	Rally 40W	2	0.8	0.071	0.71	0.0945	0.9449oz ai/10gal
Electrostatic	Rally 40W	4	1.6	0.138	1.38	0.1837	1.8367 oz ai/10gal
Conventional	Rally 40W	4	1.6	0.02	0.2	0.0266	2.6619 oz ai/100gal

Site 2-Nozzle

Equipment	Chemical	Rate		Nozzle			
		oz/acre	oz ai/acre	%	g ai/L	oz ai/gal	oz ai/gal/acre
Electrostatic	Rally 40W	2	0.8	0.07	0.7	0.09325	0.9317 oz ai/10gal
Electrostatic	Rally 40W	4	1.6	0.129	1.29	0.1717	1.7169 oz ai/10gal
Conventional	Rally 40W	4	1.6	NT	NT	NT	NT

Appendix 7. Percent mean analytical recoveries of myclobutanil added to extracts from control samples.

Site No.	LOD (µg/sample)	Level of fortification				
		10 µg/sample	**20 µg/sample**	**50 µg/sample**	**100 µg/sample**	**200 µg/sample**
1	5	97.4	108.5 107.0 101.0 95.0	101.1 104.9 88.8 110.4 104.0 111.6 108.2 123.0	89.7 109.5 112.1	78.4 91.5 90.7 110.0 107.5
2	5		88.0 96.0	171.2 154.8 105.2 100.4	96.3 102.5 121.8	95.8 110.0 107.5
3	2	96.3 165.0 103.0	114.0		108.0 100.0 95.8	101.9
4	2	93.4 94.9 101 91.5 92.9			95.1 88.3 86.3 87.6 87.4	
5	3	136 109 126 78.4			99.6 98.4 107 77.1	

LOD – Limit of detection

Appendix 8. Grape leaf surface area estimates of treatment sites (1997).

		AVERAGE*						
Site No.	Treatment	Shoot length (cm)	No. lateral shoots	No. nodes	Leaf area/ shoot (cm^2)*	Leaf area/ vine (cm^2)	Leaf area/ acre (cm^2)	Fruit stage & size in diameter
3	EHR	118.00	4	16	2,305.86	55,341	34,438,480	bloom - set
	EFR	113.75	7	14	2,091.83	50,204	31,241,899	bloom - set
	CFR	146.63	10	19	2,684.83	64,436	40,098,473	bloom
	Average	126.13	7	16	2,360.84	56,660	35,259,618	
4	EHR	146.25	10	20	2,798.14	176,283	109,700,799	0.8-1 cm
	EFR	145.50	8	23	3,922.69	247,130	153,788,669	1 cm
	CFR	152.00	6	21	2,881.88	181,558	112,983,817	0.9-1 cm
	Average	147.92	8	21	3,200.90	201,657	125,491,095	
5	EHR	147.00	8	30	3,077.91	123,116	76,615,336	After véraison
	EFR	143.25	15	29	3,936.32	157,453	97,982,877	After véraison
	CFR	145.00	12	34	2,638.35	105,534	65,673,808	After véraison
	Average	145.08	12	31	3,217.53	128,701	80,090,674	

* Average = Four random shoots per treatment (12 shoots per site); Number of vines per acre = 622.3 (7x10 ft.); Site 3 = 12 spurs per vine * 2 shoots per spur; Site 4 = 18 spurs per vine * 3.5 shoots per spur; Site 5 = 16 spurs per vine * 2.5 shoots per spur.
EHR = Electrostatic Half Rate; EFR = Electrostatic Half Rate; CFR = Conventional Full Rate.

Appendix 9. Mean temperature (°C) by day (days < 20 only).

Site	N	Mean	Tukey Grouping*	
2	20	24.05	A	
1	20	23.77	A	
5	20	22.83	A	B
4	20	21.14		B
3	20	21.09		B

*Means with the same letter are not significantly different

Appendix 10. Mean initial deposition, as represented by adjusted day one samples: Myclobutanil reduced-volume and conventional application on grapes.

Site No.	Canopy Location	Treatment	Mean Initial Deposition* Adjusted Day 1 (μg/cm²)	Standard Deviation	Coefficient of Variation (%)
1	In	EHR	0.1182	0.1047	88.56
	In	EFR	0.3124	0.1602	51.27
	In	CFR	0.1624	0.0229	14.10
	Out	EHR	0.1554	0.0259	16.64
	Out	EFR	0.2405	0.0571	23.73
	Out	CFR	0.0384	0.0133	34.65
3	In	EHR	0.1290	0.0365	28.32
	In	EFR	0.2449	0.1339	54.69
	In	CFR	0.2469	0.0138	5.61
	Out	EHR	0.1783	0.0374	20.98
	Out	EFR	0.3594	0.0409	11.38
	Out	CFR	0.2813	0.0267	9.48
4	In	EHR	0.0282	0.0096	34.01
	In	EFR	0.0259	0.0351	135.26
	In	CFR	0.1449	0.0077	5.34
	Out	EHR	0.0662	0.0146	22.11
	Out	EFR	0.1462	0.0246	16.84
	Out	CFR	0.1091	0.0137	12.55
5	In	EHR	0.0882	0.0280	31.74
	In	EFR	0.1745	0.0527	30.19
	In	CFR	0.1320	0.0552	41.80
	Out	EHR	0.0807	0.0179	22.16
	Out	EFR	0.2670	0.0150	5.62
	Out	CFR	0.0940	0.0155	16.51

*Initial deposition: day one was adjusted for myclobutanil deposition background on site 1, 4 and 5. On these sites some myclobutanil was present on the pre-application samples, which was subtracted from day one to determine initial deposition only.

IN = Inside the canopy OUT = Outside the canopy

EHR = Electrostatic Half Rate EFR = Electrostatic Half Rate CFR = Conventional Full Rate

Appendix 11. Dislodgeable foliar residue raw data indexed by site, treatment and location.

Study Site	Treatment	Location	Interval	Sample #	Lab #	Rep	Results (µg/spl)
Site 1	CFR	IN	0	AW06-1162	93	A	71.7
Site 1	CFR	IN	0	AW06-1170	101	B	46.9
Site 1	CFR	IN	1	TL01-1001	117	A	125
Site 1	CFR	IN	1	TL01-1002	118	B	112
Site 1	CFR	IN	1	TL01-1003	119	C	125
Site 1	CFR	IN	1	TL01-1004	120	D	135
Site 1	CFR	IN	3	TL03-1001	159	A	96.9
Site 1	CFR	IN	3	TL03-1002	160	B	105
Site 1	CFR	IN	3	TL03-1003	161	C	113
Site 1	CFR	IN	3	TL03-1004	162	D	96.7
Site 1	CFR	IN	7	TL07-1001	230	A	101
Site 1	CFR	IN	7	TL07-1002	231	B	112
Site 1	CFR	IN	7	TL07-1003	232	C	110
Site 1	CFR	IN	7	TL07-1004	233	D	105
Site 1	CFR	IN	14	TL14-1001	381	A	58.1
Site 1	CFR	IN	14	TL14-1002	382	B	76.6
Site 1	CFR	IN	14	TL14-1003	383	C	70.4
Site 1	CFR	IN	14	TL14-1004	384	D	61.3
Site 1	CFR	IN	19	TL21-1001	441	A	75.1
Site 1	CFR	IN	19	TL21-1002	442	B	67.1
Site 1	CFR	IN	19	TL21-1003	443	C	83.3
Site 1	CFR	IN	19	TL21-1004	444	D	71.5
Site 1	CFR	IN	26	TL26-1001	545	A	46.4
Site 1	CFR	IN	26	TL26-1002	546	B	32.1
Site 1	CFR	IN	26	TL26-1003	547	C	49.6
Site 1	CFR	IN	26	TL26-1004	548	D	33.6
Site 1	CFR	OUT	0	AW06-1163	94	A	ND
Site 1	CFR	OUT	0	AW06-1171	102	B	10.5
Site 1	CFR	OUT	1	TL01-1005	121	A	22.1
Site 1	CFR	OUT	1	TL01-1006	122	B	20
Site 1	CFR	OUT	1	TL01-1007	123	C	25.2
Site 1	CFR	OUT	1	TL01-1008	124	D	31.7
Site 1	CFR	OUT	3	TL03-1005	163	A	31.5
Site 1	CFR	OUT	3	TL03-1006	164	B	28.3
Site 1	CFR	OUT	3	TL03-1007	165	C	52.5
Site 1	CFR	OUT	3	TL03-1008	166	D	58.9
Site 1	CFR	OUT	7	TL07-1005	234	A	ND
Site 1	CFR	OUT	7	TL07-1006	235	B	ND
Site 1	CFR	OUT	7	TL07-1007	236	C	13.7
Site 1	CFR	OUT	7	TL07-1008	237	D	13.7
Site 1	CFR	OUT	14	TL14-1005	385	A	19.1
Site 1	CFR	OUT	14	TL14-1006	386	B	17.6

Appendix 11 (con't).

Study Site	Treatment	Location	Interval	Sample #	Lab #	Rep	Results (µg/spl)
Site 1	CFR	OUT	14	TL14-1007	387	C	32.2
Site 1	CFR	OUT	14	TL14-1008	388	D	25.2
Site 1	CFR	OUT	19	TL21-1005	445	A	ND
Site 1	CFR	OUT	19	TL21-1006	446	B	ND
Site 1	CFR	OUT	19	TL21-1007	447	C	ND
Site 1	CFR	OUT	19	TL21-1008	448	D	ND
Site 1	CFR	OUT	26	TL26-1005	549	A	ND
Site 1	CFR	OUT	26	TL26-1006	550	B	15.4
Site 1	CFR	OUT	26	TL26-1007	551	C	ND
Site 1	CFR	OUT	26	TL26-1008	552	D	10.8
Site 1	EFR	IN	0	AW06-1160	91	A	57.2
Site 1	EFR	IN	0	AW06-1168	99	B	65.7
Site 1	EFR	IN	1	TL01-1017	133	A	131
Site 1	EFR	IN	1	TL01-1018	134	B	135
Site 1	EFR	IN	1	TL01-1019	135	C	261
Site 1	EFR	IN	1	TL01-1020	136	D	209
Site 1	EFR	IN	3	TL03-1017	175	A	153
Site 1	EFR	IN	3	TL03-1018	176	B	126
Site 1	EFR	IN	3	TL03-1019	177	C	224
Site 1	EFR	IN	3	TL03-1020	178	D	234
Site 1	EFR	IN	7	TL07-1017	246	A	155
Site 1	EFR	IN	7	TL07-1018	247	B	174
Site 1	EFR	IN	7	TL07-1019	248	C	120
Site 1	EFR	IN	7	TL07-1020	249	D	200
Site 1	EFR	IN	14	TL14-1017	397	A	99
Site 1	EFR	IN	14	TL14-1018	398	B	108
Site 1	EFR	IN	14	TL14-1019	399	C	113
Site 1	EFR	IN	14	TL14-1020	400	D	143
Site 1	EFR	IN	19	TL21-1017	457	A	106
Site 1	EFR	IN	19	TL21-1018	458	B	102
Site 1	EFR	IN	19	TL21-1019	459	C	185
Site 1	EFR	IN	19	TL21-1020	460	D	109
Site 1	EFR	IN	26	TL26-1017	561	A	58.7
Site 1	EFR	IN	26	TL26-1018	562	B	89.8
Site 1	EFR	IN	26	TL26-1019	563	C	100
Site 1	EFR	IN	26	TL26-1020	564	D	74.7
Site 1	EFR	OUT	0	AW06-1161	92	A	28.2
Site 1	EFR	OUT	0	AW06-1169	100	B	20.9
Site 1	EFR	OUT	1	TL01-1021	137	A	157
Site 1	EFR	OUT	1	TL01-1022	138	B	111
Site 1	EFR	OUT	1	TL01-1023	139	C	100
Site 1	EFR	OUT	1	TL01-1024	140	D	115
Site 1	EFR	OUT	3	TL03-1021	179	A	173
Site 1	EFR	OUT	3	TL03-1022	180	B	166
Site 1	EFR	OUT	3	TL03-1023	181	C	165

Appendix 11 (con't).

Study Site	Treatment	Location	Interval	Sample #	Lab #	Rep	Results (µg/spl)
Site 1	EFR	OUT	3	TL03-1024	182	D	147
Site 1	EFR	OUT	7	TL07-1021	250	A	93.3
Site 1	EFR	OUT	7	TL07-1022	251	B	54.5
Site 1	EFR	OUT	7	TL07-1023	252	C	85.2
Site 1	EFR	OUT	7	TL07-1024	253	D	87.6
Site 1	EFR	OUT	14	TL14-1021	401	A	149
Site 1	EFR	OUT	14	TL14-1022	402	B	122
Site 1	EFR	OUT	14	TL14-1023	403	C	102
Site 1	EFR	OUT	14	TL14-1024	404	D	111
Site 1	EFR	OUT	19	TL21-1021	461	A	51
Site 1	EFR	OUT	19	TL21-1022	462	B	44.2
Site 1	EFR	OUT	19	TL21-1023	463	C	58.8
Site 1	EFR	OUT	19	TL21-1024	464	D	44.2
Site 1	EFR	OUT	26	TL26-1021	565	A	36.5
Site 1	EFR	OUT	26	TL26-1022	566	B	55.1
Site 1	EFR	OUT	26	TL26-1023	567	C	26.4
Site 1	EFR	OUT	26	TL26-1024	568	D	28.5
Site 1	EHR	IN	0	AW06-1150	81	A	38.9
Site 1	EHR	IN	0	AW06-1152	83	B	42.9
Site 1	EHR	IN	0	AW06-1164	95	C	26.3
Site 1	EHR	IN	1	TL01-1009	125	A	62.4
Site 1	EHR	IN	1	TL01-1010	126	B	43.8
Site 1	EHR	IN	1	TL01-1011	127	C	115
Site 1	EHR	IN	1	TL01-1012	128	D	112
Site 1	EHR	IN	3	TL03-1009	167	A	65.9
Site 1	EHR	IN	3	TL03-1010	168	B	59.5
Site 1	EHR	IN	3	TL03-1011	169	C	101
Site 1	EHR	IN	3	TL03-1012	170	D	128
Site 1	EHR	IN	7	TL07-1009	238	A	87.9
Site 1	EHR	IN	7	TL07-1010	239	B	82.8
Site 1	EHR	IN	7	TL07-1011	240	C	71.7
Site 1	EHR	IN	7	TL07-1012	241	D	97.6
Site 1	EHR	IN	14	TL14-1009	389	A	71.4
Site 1	EHR	IN	14	TL14-1010	390	B	56.4
Site 1	EHR	IN	14	TL14-1011	391	C	48.5
Site 1	EHR	IN	14	TL14-1012	392	D	57.2
Site 1	EHR	IN	19	TL21-1009	449	A	63.6
Site 1	EHR	IN	19	TL21-1010	450	B	46.4
Site 1	EHR	IN	19	TL21-1011	451	C	63.5
Site 1	EHR	IN	19	TL21-1012	452	D	62.6
Site 1	EHR	IN	26	TL26-1009	553	A	43.2
Site 1	EHR	IN	26	TL26-1010	554	B	40.3
Site 1	EHR	IN	26	TL26-1011	555	C	54.5
Site 1	EHR	IN	26	TL26-1012	556	D	64.4
Site 1	EHR	OUT	0	AW06-1151	82	A	29.5

Appendix 11 (con't).

Study Site	Treatment	Location	Interval	Sample #	Lab #	Rep	Results (µg/spl)
Site 1	EHR	OUT	0	AW06-1153	84	B	32.2
Site 1	EHR	OUT	0	AW06-1165	96	C	14.2
Site 1	EHR	OUT	1	TL01-1013	129	A	79.2
Site 1	EHR	OUT	1	TL01-1014	130	B	101
Site 1	EHR	OUT	1	TL01-1015	131	C	86.5
Site 1	EHR	OUT	1	TL01-1016	132	D	83.1
Site 1	EHR	OUT	3	TL03-1013	171	A	35.8
Site 1	EHR	OUT	3	TL03-1014	172	B	78.8
Site 1	EHR	OUT	3	TL03-1015	173	C	64.7
Site 1	EHR	OUT	3	TL03-1016	174	D	80.3
Site 1	EHR	OUT	7	TL07-1013	242	A	57.4
Site 1	EHR	OUT	7	TL07-1014	243	B	46.4
Site 1	EHR	OUT	7	TL07-1015	244	C	65.9
Site 1	EHR	OUT	7	TL07-1016	245	D	60.2
Site 1	EHR	OUT	14	TL14-1013	393	A	58.9
Site 1	EHR	OUT	14	TL14-1014	394	B	59.5
Site 1	EHR	OUT	14	TL14-1015	395	C	60.9
Site 1	EHR	OUT	14	TL14-1016	396	D	57.4
Site 1	EHR	OUT	19	TL21-1013	453	A	11.6
Site 1	EHR	OUT	19	TL21-1014	454	B	13.2
Site 1	EHR	OUT	19	TL21-1015	455	C	12.8
Site 1	EHR	OUT	19	TL21-1016	456	D	16.1
Site 1	EHR	OUT	26	TL26-1013	557	A	ND
Site 1	EHR	OUT	26	TL26-1014	558	B	ND
Site 1	EHR	OUT	26	TL26-1015	559	C	ND
Site 1	EHR	OUT	26	TL26-1016	560	D	ND
Site 2	CONTROL	IN	0	LT00-1055	318	A	ND
Site 2	CONTROL	IN	0	LT00-1056	319	B	ND
Site 2	CONTROL	IN	0	LT00-1057	304	C	77.9
Site 2	CONTROL	IN	0	LT00-1058	320	D	ND
Site 2	CONTROL	IN	1	LT01-1031	345	A	15.9
Site 2	CONTROL	IN	1	LT01-1032	346	B	22.4
Site 2	CONTROL	IN	1	LT01-1033	347	C	47.8
Site 2	CONTROL	IN	1	LT01-1034	348	D	48.9
Site 2	CONTROL	IN	3	LT03-1001	409	A	ND
Site 2	CONTROL	IN	3	LT03-1002	410	B	ND
Site 2	CONTROL	IN	3	LT03-1003	411	C	ND
Site 2	CONTROL	IN	3	LT03-1004	412	D	ND
Site 2	CONTROL	IN	8	LT08-1001	469	A	ND
Site 2	CONTROL	IN	8	LT08-1002	470	B	ND
Site 2	CONTROL	IN	8	LT08-1003	471	C	ND
Site 2	CONTROL	IN	8	LT08-1004	472	D	ND
Site 2	CONTROL	IN	14	LT14-1001	513	A	ND
Site 2	CONTROL	IN	14	LT14-1002	514	B	ND
Site 2	CONTROL	IN	14	LT14-1003	515	C	ND

Appendix 11 (con't).

Study Site	Treatment	Location	Interval	Sample #	Lab #	Rep	Results (µg/spl)
Site 2	CONTROL	IN	14	LT14-1004	516	D	ND
Site 2	CONTROL	IN	21	LT21-1001	659	A	ND
Site 2	CONTROL	IN	21	LT21-1002	660	B	ND
Site 2	CONTROL	IN	21	LT21-1003	661	C	ND
Site 2	CONTROL	IN	21	LT21-1004	662	D	ND
Site 2	CONTROL	OUT	0	LT00-1059	321	A	ND
Site 2	CONTROL	OUT	0	LT00-1060	322	B	ND
Site 2	CONTROL	OUT	0	LT00-1061	305	D	145.52
Site 2	CONTROL	OUT	0	LT00-1062	323	C	ND
Site 2	CONTROL	OUT	1	LT01-1035	349	A	67.4
Site 2	CONTROL	OUT	1	LT01-1036	350	B	66
Site 2	CONTROL	OUT	1	LT01-1037	351	C	108
Site 2	CONTROL	OUT	1	LT01-1038	352	D	132
Site 2	CONTROL	OUT	3	LT03-1005	413	A	ND
Site 2	CONTROL	OUT	3	LT03-1006	414	B	ND
Site 2	CONTROL	OUT	3	LT03-1007	415	C	ND
Site 2	CONTROL	OUT	3	LT03-1008	416	D	ND
Site 2	CONTROL	OUT	8	LT08-1005	473	A	ND
Site 2	CONTROL	OUT	8	LT08-1006	474	B	ND
Site 2	CONTROL	OUT	8	LT08-1007	475	C	ND
Site 2	CONTROL	OUT	8	LT08-1008	476	D	ND
Site 2	CONTROL	OUT	14	LT14-1005	517	A	ND
Site 2	CONTROL	OUT	14	LT14-1006	518	B	ND
Site 2	CONTROL	OUT	14	LT14-1007	519	C	ND
Site 2	CONTROL	OUT	14	LT14-1008	520	D	ND
Site 2	CONTROL	OUT	21	LT21-1005	663	A	ND
Site 2	CONTROL	OUT	21	LT21-1006	664	B	ND
Site 2	CONTROL	OUT	21	LT21-1007	665	C	ND
Site 2	CONTROL	OUT	21	LT21-1008	666	D	ND
Site 2	CFR	IN	0	LT00-1031	280	A	ND
Site 2	CFR	IN	0	LT00-1032	281	B	ND
Site 2	CFR	IN	0	LT00-1033	282	C	ND
Site 2	CFR	IN	0	LT00-1034	283	D	ND
Site 2	CFR	IN	1	LT01-1039	353	A	22.7
Site 2	CFR	IN	1	LT01-1040	354	B	28
Site 2	CFR	IN	1	LT01-1041	355	C	16.8
Site 2	CFR	IN	1	LT01-1042	356	D	39.1
Site 2	CFR	IN	3	LT03-1009	417	A	87.2
Site 2	CFR	IN	3	LT03-1010	418	B	72.9
Site 2	CFR	IN	3	LT03-1011	419	C	74.3
Site 2	CFR	IN	3	LT03-1012	420	D	77
Site 2	CFR	IN	8	LT08-1009	477	A	66.2
Site 2	CFR	IN	8	LT08-1010	478	B	64.2
Site 2	CFR	IN	8	LT08-1011	479	C	74.8
Site 2	CFR	IN	8	LT08-1012	480	D	70

Appendix 11 (con't).

Study Site	Treatment	Location	Interval	Sample #	Lab #	Rep	Results (µg/spl)
Site 2	CFR	IN	14	LT14-1009	521	A	36.9
Site 2	CFR	IN	14	LT14-1010	522	B	31.1
Site 2	CFR	IN	14	LT14-1011	523	C	43.2
Site 2	CFR	IN	14	LT14-1012	524	D	39.5
Site 2	CFR	IN	21	LT21-1009	667	A	31.2
Site 2	CFR	IN	21	LT21-1010	668	B	35
Site 2	CFR	IN	21	LT21-1011	669	C	31.1
Site 2	CFR	IN	21	LT21-1012	670	D	36.5
Site 2	CFR	OUT	0	LT00-1035	284	A	ND
Site 2	CFR	OUT	0	LT00-1036	285	B	ND
Site 2	CFR	OUT	0	LT00-1037	286	C	ND
Site 2	CFR	OUT	0	LT00-1038	287	D	ND
Site 2	CFR	OUT	1	LT01-1043	357	A	44.8
Site 2	CFR	OUT	1	LT01-1044	358	B	81.2
Site 2	CFR	OUT	1	LT01-1045	359	C	38.8
Site 2	CFR	OUT	1	LT01-1046	360	D	83.3
Site 2	CFR	OUT	3	LT03-1013	421	A	38.5
Site 2	CFR	OUT	3	LT03-1014	422	B	61.2
Site 2	CFR	OUT	3	LT03-1015	423	C	69.1
Site 2	CFR	OUT	3	LT03-1016	424	D	88.2
Site 2	CFR	OUT	8	LT08-1013	481	A	30.3
Site 2	CFR	OUT	8	LT08-1014	482	B	28.3
Site 2	CFR	OUT	8	LT08-1015	483	C	41.8
Site 2	CFR	OUT	8	LT08-1016	484	D	29
Site 2	CFR	OUT	14	LT14-1013	525	A	17.3
Site 2	CFR	OUT	14	LT14-1014	526	B	18.6
Site 2	CFR	OUT	14	LT14-1015	527	C	27.4
Site 2	CFR	OUT	14	LT14-1016	528	D	19.4
Site 2	CFR	OUT	21	LT21-1013	671	A	14.2
Site 2	CFR	OUT	21	LT21-1014	672	B	13.2
Site 2	CFR	OUT	21	LT21-1015	673	C	14.1
Site 2	CFR	OUT	21	LT21-1016	674	D	19
Site 2	ESF	IN	0	LT00-1039	288	A	ND
Site 2	EFR	IN	0	LT00-1040	289	B	ND
Site 2	EFR	IN	0	LT00-1041	290	C	ND
Site 2	EFR	IN	0	LT00-1042	291	D	ND
Site 2	EFR	IN	1	LT01-1047	361	A	35
Site 2	EFR	IN	1	LT01-1048	362	B	53.8
Site 2	EFR	IN	1	LT01-1049	363	C	35.9
Site 2	EFR	IN	1	LT01-1050	364	D	32.1
Site 2	EFR	IN	3	LT03-1017	425	A	26.9
Site 2	EFR	IN	3	LT03-1018	426	B	35.6
Site 2	EFR	IN	3	LT03-1019	427	C	21.7
Site 2	EFR	IN	3	LT03-1020	428	D	62.2
Site 2	EFR	IN	8	LT08-1017	485	A	21.7

Appendix 11 (con't).

Study Site	Treatment	Location	Interval	Sample #	Lab #	Rep	Results (µg/spl)
Site 2	EFR	IN	8	LT08-1018	486	B	28.3
Site 2	EFR	IN	8	LT08-1019	487	C	18.9
Site 2	EFR	IN	8	LT08-1020	488	D	25.1
Site 2	EFR	IN	14	LT14-1017	529	A	ND
Site 2	EFR	IN	14	LT14-1018	530	B	ND
Site 2	EFR	IN	14	LT14-1019	531	C	ND
Site 2	EFR	IN	14	LT14-1020	532	D	ND
Site 2	EFR	IN	21	LT21-1017	675	A	11.1
Site 2	EFR	IN	21	LT21-1018	676	B	17.8
Site 2	EFR	IN	21	LT21-1019	677	C	14.3
Site 2	EFR	IN	21	LT21-1020	678	D	19.6
Site 2	EFR	OUT	0	LT00-1043	292	A	ND
Site 2	EFR	OUT	0	LT00-1044	293	B	ND
Site 2	EFR	OUT	0	LT00-1045	294	C	ND
Site 2	EFR	OUT	0	LT00-1046	295	D	ND
Site 2	EFR	OUT	1	LT01-1051	365	A	87.8
Site 2	EFR	OUT	1	LT01-1052	366	B	85.7
Site 2	EFR	OUT	1	LT01-1053	367	C	69.5
Site 2	EFR	OUT	1	LT01-1054	368	D	87.5
Site 2	EFR	OUT	3	LT03-1021	429	A	49.2
Site 2	EFR	OUT	3	LT03-1022	430	B	61
Site 2	EFR	OUT	3	LT03-1023	431	C	56.8
Site 2	EFR	OUT	3	LT03-1024	432	D	67.9
Site 2	EFR	OUT	8	LT08-1021	489	A	52.8
Site 2	EFR	OUT	8	LT08-1022	490	B	69.9
Site 2	EFR	OUT	8	LT08-1023	491	C	43.1
Site 2	EFR	OUT	8	LT08-1024	492	D	52.6
Site 2	EFR	OUT	14	LT14-1021	533	A	15.9
Site 2	EFR	OUT	14	LT14-1022	534	B	ND
Site 2	EFR	OUT	14	LT14-1023	535	C	ND
Site 2	EFR	OUT	14	LT14-1024	536	D	ND
Site 2	EFR	OUT	21	LT21-1021	679	A	ND
Site 2	EFR	OUT	21	LT21-1022	680	B	12.3
Site 2	EFR	OUT	21	LT21-1023	681	C	ND
Site 2	EFR	OUT	21	LT21-1024	682	D	14.4
Site 2	EHR	IN	0	LT00-1047	296	A	ND
Site 2	EHR	IN	0	LT00-1048	297	B	ND
Site 2	EHR	IN	0	LT00-1049	298	C	ND
Site 2	EHR	IN	0	LT00-1050	299	D	ND
Site 2	EHR	IN	1	LT01-1055	369	A	86.4
Site 2	EHR	IN	1	LT01-1056	370	B	71.4
Site 2	EHR	IN	1	LT01-1057	371	C	82.6
Site 2	EHR	IN	1	LT01-1058	372	D	71.8
Site 2	EHR	IN	3	LT03-1025	433	A	14.4
Site 2	EHR	IN	3	LT03-1026	434	B	14.8

Appendix 11 (con't).

Study Site	Treatment	Location	Interval	Sample #	Lab #	Rep	Results (µg/spl)
Site 2	EHR	IN	3	LT03-1027	435	C	10
Site 2	EHR	IN	3	LT03-1028	436	D	18.9
Site 2	EHR	IN	8	LT08-1025	493	A	11.5
Site 2	EHR	IN	8	LT08-1026	494	B	14.1
Site 2	EHR	IN	8	LT08-1027	495	C	16.3
Site 2	EHR	IN	8	LT08-1028	496	D	20.3
Site 2	EHR	IN	14	LT14-1025	537	A	ND
Site 2	EHR	IN	14	LT14-1026	538	B	13.6
Site 2	EHR	IN	14	LT14-1027	539	C	ND
Site 2	EHR	IN	14	LT14-1028	540	D	13.2
Site 2	EHR	IN	21	LT21-1025	683	A	ND
Site 2	EHR	IN	21	LT21-1026	684	B	ND
Site 2	EHR	IN	21	LT21-1027	685	C	ND
Site 2	EHR	IN	21	LT21-1028	686	D	14.1
Site 2	EHR	OUT	0	LT00-1051	300	A	ND
Site 2	EHR	OUT	0	LT00-1052	301	B	ND
Site 2	EHR	OUT	0	LT00-1053	302	C	ND
Site 2	EHR	OUT	0	LT00-1054	303	D	ND
Site 2	EHR	OUT	1	LT01-1059	373	A	42.3
Site 2	EHR	OUT	1	LT01-1060	374	B	66.9
Site 2	EHR	OUT	1	LT01-1061	375	C	71.1
Site 2	EHR	OUT	1	LT01-1062	376	D	81.1
Site 2	EHR	OUT	3	LT03-1029	437	A	29.6
Site 2	EHR	OUT	3	LT03-1030	438	B	50
Site 2	EHR	OUT	3	LT03-1031	439	C	27.4
Site 2	EHR	OUT	3	LT03-1032	440	D	39.9
Site 2	EHR	OUT	8	LT08-1029	497	A	34.1
Site 2	EHR	OUT	8	LT08-1030	498	B	36.3
Site 2	EHR	OUT	8	LT08-1031	499	C	35.2
Site 2	EHR	OUT	8	LT08-1032	500	D	19.4
Site 2	EHR	OUT	14	LT14-1029	541	A	ND
Site 2	EHR	OUT	14	LT14-1030	542	B	ND
Site 2	EHR	OUT	14	LT14-1031	543	C	14.6
Site 2	EHR	OUT	14	LT14-1032	544	D	10.1
Site 2	EHR	OUT	21	LT21-1029	687	A	ND
Site 2	EHR	OUT	21	LT21-1030	688	B	ND
Site 2	EHR	OUT	21	LT21-1031	689	C	ND
Site 2	EHR	OUT	21	LT21-1032	690	D	ND
Site 2	QC		1	LT01-1063	377		ND
Site 2	QC		1	LT01-1064	378		ND
Site 2	QC		1	LT01-1065	379		ND
Site 2	QC		1	LT01-1066	380		121.8
Site 3	CONTROL	IN	7.5	MC14-1106	1660	A	ND
Site 3	CONTROL	IN	16.5	MC16-1158	1820	A	ND
Site 3	CONTROL	OUT	7.5	MC14-1107	1661	A	ND

Appendix 11 (con't).

Study Site	Treatment	Location	Interval	Sample #	Lab #	Rep	Results (µg/spl)
Site 3	CONTROL	OUT	16.5	MC16-1159	1821	A	ND
Site 3	CFR	IN	0.5	MC-1041	1505	A	93.2
Site 3	CFR	IN	0.5	MC-1042	1506	B	104
Site 3	CFR	IN	0.5	MC-1043	1507	C	103
Site 3	CFR	IN	0.5	MC-1044	1508	D	94.8
Site 3	CFR	IN	2.5	MC13-1072	1570	A	80.8
Site 3	CFR	IN	2.5	MC13-1073	1571	B	82.7
Site 3	CFR	IN	2.5	MC13-1074	1572	C	90.9
Site 3	CFR	IN	2.5	MC13-1075	1573	D	87.6
Site 3	CFR	IN	7.5	MC14-1098	1652	A	89.3
Site 3	CFR	IN	7.5	MC14-1099	1653	B	76.5
Site 3	CFR	IN	7.5	MC14-1100	1654	C	73.2
Site 3	CFR	IN	7.5	MC14-1101	1655	D	80.9
Site 3	CFR	IN	13.5	MC15-1124	1759	A	62.6
Site 3	CFR	IN	13.5	MC15-1125	1760	B	70.9
Site 3	CFR	IN	13.5	MC15-1126	1761	C	70
Site 3	CFR	IN	13.5	MC15-1127	1762	D	68.6
Site 3	CFR	IN	16.5	MC16-1150	1812	A	59.4
Site 3	CFR	IN	16.5	MC16-1151	1813	B	73.7
Site 3	CFR	IN	16.5	MC16-1152	1814	C	59
Site 3	CFR	IN	16.5	MC16-1153	1815	D	59.3
Site 3	CFR	OUT	0.5	MC-1045	1509	A	123
Site 3	CFR	OUT	0.5	MC-1046	1510	B	120
Site 3	CFR	OUT	0.5	MC-1047	1511	C	101
Site 3	CFR	OUT	0.5	MC-1048	1512	D	106
Site 3	CFR	OUT	2.5	MC13-1076	1574	A	86.1
Site 3	CFR	OUT	2.5	MC13-1077	1575	B	84.9
Site 3	CFR	OUT	2.5	MC13-1078	1576	C	72.6
Site 3	CFR	OUT	2.5	MC13-1079	1577	D	60.2
Site 3	CFR	OUT	7.5	MC14-1102	1656	A	67.7
Site 3	CFR	OUT	7.5	MC14-1103	1657	B	58.5
Site 3	CFR	OUT	7.5	MC14-1104	1658	C	41.3
Site 3	CFR	OUT	7.5	MC14-1105	1659	D	43
Site 3	CFR	OUT	13.5	MC15-1128	1763	A	38.1
Site 3	CFR	OUT	13.5	MC15-1129	1764	B	38.1
Site 3	CFR	OUT	13.5	MC15-1130	1765	C	23.1
Site 3	CFR	OUT	13.5	MC15-1131	1766	D	27.4
Site 3	CFR	OUT	16.5	MC16-1154	1816	A	34.9
Site 3	CFR	OUT	16.5	MC16-1155	1817	B	30.7
Site 3	CFR	OUT	16.5	MC16-1156	1818	C	19.9
Site 3	CFR	OUT	16.5	MC16-1157	1819	D	22.1
Site 3	EFR	IN	0.5	MC-1033	1497	A	48.2
Site 3	EFR	IN	0.5	MC-1034	1498	B	55.6
Site 3	EFR	IN	0.5	MC-1035	1499	C	151
Site 3	EFR	IN	0.5	MC-1036	1500	D	137

Appendix 11 (con't).

Study Site	Treatment	Location	Interval	Sample #	Lab #	Rep	Results (µg/spl)
Site 3	EFR	IN	2.5	MC13-1064	1562	A	47.5
Site 3	EFR	IN	2.5	MC13-1065	1563	B	47
Site 3	EFR	IN	2.5	MC13-1066	1564	C	104
Site 3	EFR	IN	2.5	MC13-1067	1565	D	114
Site 3	EFR	IN	7.5	MC14-1090	1644	A	48.9
Site 3	EFR	IN	7.5	MC14-1091	1645	B	52.1
Site 3	EFR	IN	7.5	MC14-1092	1646	C	186
Site 3	EFR	IN	7.5	MC14-1093	1647	D	149
Site 3	EFR	IN	13.5	MC15-1116	1751	A	38.5
Site 3	EFR	IN	13.5	MC15-1117	1752	B	48.7
Site 3	EFR	IN	13.5	MC15-1118	1753	C	134
Site 3	EFR	IN	13.5	MC15-1119	1754	D	168
Site 3	EFR	IN	16.5	MC16-1142	1804	A	45
Site 3	EFR	IN	16.5	MC16-1143	1805	B	45.3
Site 3	EFR	IN	16.5	MC16-1144	1806	C	155
Site 3	EFR	IN	16.5	MC16-1145	1807	D	137
Site 3	EFR	OUT	0.5	MC-1037	1501	A	133
Site 3	EFR	OUT	0.5	MC-1038	1502	B	168
Site 3	EFR	OUT	0.5	MC-1039	1503	C	135
Site 3	EFR	OUT	0.5	MC-1040	1504	D	139
Site 3	EFR	OUT	2.5	MC13-1068	1566	A	131
Site 3	EFR	OUT	2.5	MC13-1069	1567	B	112
Site 3	EFR	OUT	2.5	MC13-1070	1568	C	91.4
Site 3	EFR	OUT	2.5	MC13-1071	1569	D	119
Site 3	EFR	OUT	7.5	MC14-1094	1648	A	100
Site 3	EFR	OUT	7.5	MC14-1095	1649	B	90.7
Site 3	EFR	OUT	7.5	MC14-1096	1650	C	76.2
Site 3	EFR	OUT	7.5	MC14-1097	1651	D	86.4
Site 3	EFR	OUT	13.5	MC15-1120	1755	A	48.8
Site 3	EFR	OUT	13.5	MC15-1121	1756	B	59.8
Site 3	EFR	OUT	13.5	MC15-1122	1757	C	48.8
Site 3	EFR	OUT	13.5	MC15-1123	1758	D	37.6
Site 3	EFR	OUT	16.5	MC16-1146	1808	A	60.6
Site 3	EFR	OUT	16.5	MC16-1147	1809	B	36.6
Site 3	EFR	OUT	16.5	MC16-1148	1810	C	42.1
Site 3	EFR	OUT	16.5	MC16-1149	1811	D	31.7
Site 3	EHR	IN	0	MC-1001	1449	A	ND
Site 3	EHR	IN	0	MC-1002	1450	B	2.71
Site 3	EHR	IN	0	MC-1003	1451	C	ND
Site 3	EHR	IN	0	MC-1004	1452	D	ND
Site 3	EHR	IN	0.5	MC-1025	1489	A	49.9
Site 3	EHR	IN	0.5	MC-1026	1490	B	35.5
Site 3	EHR	IN	0.5	MC-1027	1491	C	71
Site 3	EHR	IN	0.5	MC-1028	1492	D	49.9
Site 3	EHR	IN	2.5	MC13-1056	1554	A	40.1

Appendix 11 (con't).

Study Site	Treatment	Location	Interval	Sample #	Lab #	Rep	Results (µg/spl)
Site 3	EHR	IN	2.5	MC13-1057	1555	B	34.1
Site 3	EHR	IN	2.5	MC13-1058	1556	C	50.1
Site 3	EHR	IN	2.5	MC13-1059	1557	D	46.7
Site 3	EHR	IN	7.5	MC14-1082	1636	A	30.9
Site 3	EHR	IN	7.5	MC14-1083	1637	B	31.5
Site 3	EHR	IN	7.5	MC14-1084	1638	C	54.9
Site 3	EHR	IN	7.5	MC14-1085	1639	D	61.8
Site 3	EHR	IN	13.5	MC15-1108	1743	A	27.8
Site 3	EHR	IN	13.5	MC15-1109	1744	B	22.2
Site 3	EHR	IN	13.5	MC15-1110	1745	C	45.1
Site 3	EHR	IN	13.5	MC15-1111	1746	D	46.1
Site 3	EHR	IN	16.5	MC16-1134	1796	A	19.2
Site 3	EHR	IN	16.5	MC16-1135	1797	B	22.7
Site 3	EHR	IN	16.5	MC16-1136	1798	C	59.5
Site 3	EHR	IN	16.5	MC16-1137	1799	D	39
Site 3	EHR	OUT	0	MC-1005	1453	A	2.03
Site 3	EHR	OUT	0	MC-1006	1454	B	4.95
Site 3	EHR	OUT	0	MC-1007	1455	C	4.15
Site 3	EHR	OUT	0.5	MC-1029	1493	A	56.4
Site 3	EHR	OUT	0.5	MC-1030	1494	B	60.5
Site 3	EHR	OUT	0.5	MC-1031	1495	C	84.8
Site 3	EHR	OUT	0.5	MC-1032	1496	D	83.6
Site 3	EHR	OUT	2.5	MC13-1060	1558	A	59.6
Site 3	EHR	OUT	2.5	MC13-1061	1559	B	52.7
Site 3	EHR	OUT	2.5	MC13-1062	1560	C	56
Site 3	EHR	OUT	2.5	MC13-1063	1561	D	65.1
Site 3	EHR	OUT	7.5	MC14-1086	1640	A	60.8
Site 3	EHR	OUT	7.5	MC14-1087	1641	B	37.1
Site 3	EHR	OUT	7.5	MC14-1088	1642	C	51.4
Site 3	EHR	OUT	7.5	MC14-1089	1643	D	56.5
Site 3	EHR	OUT	13.5	MC15-1112	1747	A	14.5
Site 3	EHR	OUT	13.5	MC15-1113	1748	B	19.4
Site 3	EHR	OUT	13.5	MC15-1114	1749	C	22.4
Site 3	EHR	OUT	13.5	MC15-1115	1750	D	23.5
Site 3	EHR	OUT	16.5	MC16-1138	1800	A	17.7
Site 3	EHR	OUT	16.5	MC16-1139	1801	B	22.9
Site 3	EHR	OUT	16.5	MC16-1140	1802	C	23.7
Site 3	EHR	OUT	16.5	MC16-1141	1803	D	24.7
Site 4	CFR	IN	0	JL01-1017	2023	A	21.6
Site 4	CFR	IN	0	JL01-1018	2024	B	23.4
Site 4	CFR	IN	0	JL01-1019	2025	C	32.7
Site 4	CFR	IN	0	JL01-1020	2026	D	28.5
Site 4	CFR	IN	1	JL02-1043	2049	A	84
Site 4	CFR	IN	1	JL02-1044	2050	B	80.9
Site 4	CFR	IN	1	JL02-1045	2051	C	89.3

Appendix 11 (con't).

Study Site	Treatment	Location	Interval	Sample #	Lab #	Rep	Results (µg/spl)
Site 4	CFR	IN	1	JL02-1046	2052	D	83.8
Site 4	CFR	IN	3	JL03-1069	2105	A	72.3
Site 4	CFR	IN	3	JL03-1070	2106	B	72.3
Site 4	CFR	IN	3	JL03-1071	2107	C	72.5
Site 4	CFR	IN	3	JL03-1072	2108	D	77.9
Site 4	CFR	IN	7	JL04-1095	2155	A	44.7
Site 4	CFR	IN	7	JL04-1096	2156	B	52.6
Site 4	CFR	IN	7	JL04-1097	2157	C	44.1
Site 4	CFR	IN	7	JL04-1098	2158	D	51
Site 4	CFR	IN	14	JL05-1121	2241	A	41.2
Site 4	CFR	IN	14	JL05-1122	2242	B	39.9
Site 4	CFR	IN	14	JL05-1123	2243	C	42.9
Site 4	CFR	IN	14	JL05-1124	2244	D	39.8
Site 4	CFR	OUT	0	JL01-1021	2027	A	2.5
Site 4	CFR	OUT	0	JL01-1022	2028	B	3.89
Site 4	CFR	OUT	0	JL01-1023	2029	C	7
Site 4	CFR	OUT	0	JL01-1024	2030	D	8.77
Site 4	CFR	OUT	1	JL02-1047	2053	A	46
Site 4	CFR	OUT	1	JL02-1048	2054	B	54.4
Site 4	CFR	OUT	1	JL02-1049	2055	C	50.4
Site 4	CFR	OUT	1	JL02-1050	2056	D	45.9
Site 4	CFR	OUT	3	JL03-1073	2109	A	36.6
Site 4	CFR	OUT	3	JL03-1074	2110	B	33.5
Site 4	CFR	OUT	3	JL03-1075	2111	C	35.1
Site 4	CFR	OUT	3	JL03-1076	2112	D	36.3
Site 4	CFR	OUT	7	JL04-1099	2159	A	6.7
Site 4	CFR	OUT	7	JL04-1100	2160	B	10.1
Site 4	CFR	OUT	7	JL04-1101	2161	C	7.57
Site 4	CFR	OUT	7	JL04-1102	2162	D	9.96
Site 4	CFR	OUT	14	JL05-1125	2245	A	9.09
Site 4	CFR	OUT	14	JL05-1126	2246	B	9.67
Site 4	CFR	OUT	14	JL05-1127	2247	C	9.06
Site 4	CFR	OUT	14	JL05-1128	2248	D	9.73
Site 4	EFR	IN	0	JL01-1009	2015	A	66
Site 4	EFR	IN	0	JL01-1010	2016	B	102
Site 4	EFR	IN	0	JL01-1011	2017	C	51
Site 4	EFR	IN	0	JL01-1012	2018	D	58.8
Site 4	EFR	IN	1	JL02-1035	2041	A	83.4
Site 4	EFR	IN	1	JL02-1036	2042	B	91.9
Site 4	EFR	IN	1	JL02-1037	2043	C	72
Site 4	EFR	IN	1	JL02-1038	2044	D	72

Appendix 11 (con't).

Study Site	Treatment	Location	Interval	Sample #	Lab #	Rep	Results (µg/spl)
Site 4	EFR	IN	3	JL03-1061	2097	A	65.4
Site 4	EFR	IN	3	JL03-1062	2098	B	73.3
Site 4	EFR	IN	3	JL03-1063	2099	C	60.8
Site 4	EFR	IN	3	JL03-1064	2100	D	63.5
Site 4	EFR	IN	7	JL04-1087	2147	A	30.8
Site 4	EFR	IN	7	JL04-1088	2148	B	54.8
Site 4	EFR	IN	7.0	JL04-1089	2149	C	42.3
Site 4	EFR	IN	7	JL04-1090	2150	D	41.3
Site 4	EFR	IN	14	JL05-1113	2233	A	36.2
Site 4	EFR	IN	14	JL05-1114	2234	B	62
Site 4	EFR	IN	14	JL05-1115	2235	C	54.9
Site 4	EFR	IN	14	JL05-1116	2236	D	56.7
Site 4	EFR	OUT	0	JL01-1013	2019	A	8.73
Site 4	EFR	OUT	0	JL01-1014	2020	B	8.53
Site 4	EFR	OUT	0	JL01-1015	2021	C	12.9
Site 4	EFR	OUT	0	JL01-1016	2022	D	10.3
Site 4	EFR	OUT	1	JL02-1039	2045	A	77.8
Site 4	EFR	OUT	1	JL02-1040	2046	B	72.3
Site 4	EFR	OUT	1	JL02-1041	2047	C	67
Site 4	EFR	OUT	1	JL02-1042	2048	D	57.3
Site 4	EFR	OUT	3	JL03-1065	2101	A	58.6
Site 4	EFR	OUT	3	JL03-1066	2102	B	54.1
Site 4	EFR	OUT	3	JL03-1067	2103	C	50
Site 4	EFR	OUT	3	JL03-1068	2104	D	43.5
Site 4	EFR	OUT	7	JL04-1091	2151	A	40
Site 4	EFR	OUT	7	JL04-1092	2152	B	8.1
Site 4	EFR	OUT	7	JL04-1093	2153	C	9.1
Site 4	EFR	OUT	7	JL04-1094	2154	D	14.2
Site 4	EFR	OUT	14	JL05-1117	2237	A	10
Site 4	EFR	OUT	14	JL05-1118	2238	B	12
Site 4	EFR	OUT	14	JL05-1119	2239	C	13.1
Site 4	EFR	OUT	14	JL05-1120	2240	D	9.1
Site 4	EHR	IN	0	JL01-1001	2007	A	20.4
Site 4	EHR	IN	0	JL01-1002	2008	B	24.3
Site 4	EHR	IN	0	JL01-1003	2009	C	ND
Site 4	EHR	IN	0	JL01-1004	2010	D	18.8
Site 4	EHR	IN	1	JL02-1027	2033	A	28.1
Site 4	EHR	IN	1	JL02-1028	2034	B	33.9
Site 4	EHR	IN	1	JL02-1029	2035	C	23.3
Site 4	EHR	IN	1	JL02-1030	2036	D	30
Site 4	EHR	IN	3	JL03-1053	2089	A	25.4
Site 4	EHR	IN	3	JL03-1054	2090	B	32.5
Site 4	EHR	IN	3	JL03-1055	2091	C	24.2

Appendix 11 (con't).

Study Site	Treatment	Location	Interval	Sample #	Lab #	Rep	Results (µg/spl)
Site 4	EHR	IN	3	JL03-1056	2092	D	16.7
Site 4	EHR	IN	7	JL04-1079	2139	A	16.1
Site 4	EHR	IN	7	JL04-1080	2140	B	26.8
Site 4	EHR	IN	7	JL04-1081	2141	C	19.6
Site 4	EHR	IN	7	JL04-1082	2142	D	9.6
Site 4	EHR	IN	14	JL05-1105	2225	A	14.9
Site 4	EHR	IN	14	JL05-1106	2226	B	18.4
Site 4	EHR	IN	14	JL05-1107	2227	C	17.4
Site 4	EHR	IN	14	JL05-1108	2228	D	18.3
Site 4	EHR	OUT	0	JL01-1005	2011	A	ND
Site 4	EHR	OUT	0	JL01-1006	2012	B	ND
Site 4	EHR	OUT	0	JL01-1007	2013	C	17
Site 4	EHR	OUT	0	JL01-1008	2014	D	3.7
Site 4	EHR	OUT	1	JL02-1031	2037	A	25.1
Site 4	EHR	OUT	1	JL02-1032	2038	B	37.6
Site 4	EHR	OUT	1	JL02-1033	2039	C	39.2
Site 4	EHR	OUT	1	JL02-1034	2040	D	31.3
Site 4	EHR	OUT	3	JL03-1057	2093	A	17.1
Site 4	EHR	OUT	3	JL03-1058	2094	B	25.6
Site 4	EHR	OUT	3	JL03-1059	2095	C	23.2
Site 4	EHR	OUT	3	JL03-1060	2096	D	22
Site 4	EHR	OUT	7	JL04-1083	2143	A	4.06
Site 4	EHR	OUT	7	JL04-1084	2144	B	12.1
Site 4	EHR	OUT	7	JL04-1085	2145	C	10.8
Site 4	EHR	OUT	7	JL04-1086	2146	D	5.8
Site 4	EHR	OUT	14	JL05-1109	2229	A	2.6
Site 4	EHR	OUT	14	JL05-1110	2230	B	3.03
Site 4	EHR	OUT	14	JL05-1111	2231	C	2.64
Site 4	EHR	OUT	14	JL05-1112	2232	D	4.88
Site 5	CONTROL	IN	0	LT11-1079	WHS-41	A	ND
Site 5	CONTROL	IN	1	LT12-1107	WHS-69	A	ND
Site 5	CONTROL	IN	3	LT13-1135	WHS-109	A	ND
Site 5	CONTROL	IN	7	LT14-1163	WHS-138	A	ND
Site 5	CONTROL	IN	14	LT15-1191	WHS-173	A	ND
Site 5	CONTROL	IN	21	LT16-1219	WHS-217	A	ND
Site 5	CONTROL	OUT	0	LT11-1080	WHS-42	B	ND
Site 5	CONTROL	OUT	1	LT12-1108	WHS-70	B	ND
Site 5	CONTROL	OUT	3	LT13-1136	WHS-110	B	ND
Site 5	CONTROL	OUT	7	LT14-1164	WHS-139	B	ND
Site 5	CONTROL	OUT	14	LT15-1192	WHS-174	B	ND
Site 5	CONTROL	OUT	21	LT16-1220	WHS-218	B	ND

Appendix 11 (con't).

Study Site	Treatment	Location	Interval	Sample #	Lab #	Rep	Results (µg/spl)
Site 5	CFR	IN	0	LT11-1071	WHS-33	A	50.8
Site 5	CFR	IN	0	LT11-1072	WHS-34	B	65
Site 5	CFR	IN	0	LT11-1073	WHS-35	C	66.1
Site 5	CFR	IN	0	LT11-1074	WHS-36	D	33.9
Site 5	CFR	IN	1	LT12-1099	WHS-61	A	121
Site 5	CFR	IN	1	LT12-1100	WHS-62	B	117
Site 5	CFR	IN	1	LT12-1101	WHS-63	C	88
Site 5	CFR	IN	1	LT12-1102	WHS-64	D	101
Site 5	CFR	IN	3	LT13-1127	WHS-101	A	95
Site 5	CFR	IN	3	LT13-1128	WHS-102	B	117
Site 5	CFR	IN	3	LT13-1129	WHS-103	C	77.6
Site 5	CFR	IN	3	LT13-1130	WHS-104	D	89.1
Site 5	CFR	IN	7	LT14-1155	WHS-130	A	94.6
Site 5	CFR	IN	7	LT14-1156	WHS-131	B	93.6
Site 5	CFR	IN	7	LT14-1157	WHS-132	C	73.9
Site 5	CFR	IN	7	LT14-1158	WHS-133	D	58.6
Site 5	CFR	IN	14	LT15-1183	WHS-165	A	83.1
Site 5	CFR	IN	14	LT15-1184	WHS-166	B	83
Site 5	CFR	IN	14	LT15-1185	WHS-167	C	57
Site 5	CFR	IN	14	LT15-1186	WHS-168	D	72.3
Site 5	CFR	IN	21	LT16-1211	WHS-209	A	53.7
Site 5	CFR	IN	21	LT16-1212	WHS-210	B	70.3
Site 5	CFR	IN	21	LT16-1213	WHS-211	C	48.1
Site 5	CFR	IN	21	LT16-1214	WHS-212	D	36.2
Site 5	CFR	OUT	0	LT11-1075	WHS-37	A	6.3
Site 5	CFR	OUT	0	LT11-1076	WHS-38	B	ND
Site 5	CFR	OUT	0	LT11-1077	WHS-39	C	3.97
Site 5	CFR	OUT	0	LT11-1078	WHS-40	D	ND
Site 5	CFR	OUT	1	LT12-1103	WHS-65	A	47.2
Site 5	CFR	OUT	1	LT12-1104	WHS-66	B	34
Site 5	CFR	OUT	1	LT12-1105	WHS-67	C	41.3
Site 5	CFR	OUT	1	LT12-1106	WHS-68	D	48.1
Site 5	CFR	OUT	3	LT13-1131	WHS-105	A	21.4
Site 5	CFR	OUT	3	LT13-1132	WHS-106	B	12.4
Site 5	CFR	OUT	3	LT13-1133	WHS-107	C	20.7
Site 5	CFR	OUT	3	LT13-1134	WHS-108	D	20.5
Site 5	CFR	OUT	7	LT14-1159	WHS-134	A	15.2
Site 5	CFR	OUT	7	LT14-1160	WHS-135	B	13
Site 5	CFR	OUT	7	LT14-1161	WHS-136	C	19.1
Site 5	CFR	OUT	7	LT14-1162	WHS-137	D	12.1

Appendix 11 (con't).

Study Site	Treatment	Location	Interval	Sample #	Lab #	Rep	Results (µg/spl)
Site 5	CFR	OUT	14	LT15-1187	WHS-169	A	11.5
Site 5	CFR	OUT	14	LT15-1188	WHS-170	B	9.23
Site 5	CFR	OUT	14	LT15-1189	WHS-171	C	8.95
Site 5	CFR	OUT	14	LT15-1190	WHS-172	D	10.1
Site 5	CFR	OUT	21	LT16-1215	WHS-213	A	9.11
Site 5	CFR	OUT	21	LT16-1216	WHS-214	B	4.13
Site 5	CFR	OUT	21	LT16-1217	WHS-215	C	5.28
Site 5	CFR	OUT	21	LT16-1218	WHS-216	D	5.31
Site 5	EFR	IN	0	LT11-1063	WHS-25	A	51.2
Site 5	EFR	IN	0	LT11-1064	WHS-26	B	62.8
Site 5	EFR	IN	0	LT11-1065	WHS-27	C	27.1
Site 5	EFR	IN	0	LT11-1066	WHS-28	D	50.7
Site 5	EFR	IN	1	LT12-1091	WHS-53	A	110
Site 5	EFR	IN	1	LT12-1092	WHS-54	B	118
Site 5	EFR	IN	1	LT12-1093	WHS-55	C	128
Site 5	EFR	IN	1	LT12-1094	WHS-56	D	115
Site 5	EFR	IN	3	LT13-1119	WHS-93	A	82.1
Site 5	EFR	IN	3	LT13-1120	WHS-94	B	81.5
Site 5	EFR	IN	3	LT13-1121	WHS-95	C	103
Site 5	EFR	IN	3	LT13-1122	WHS-96	D	131
Site 5	EFR	IN	7	LT14-1147	WHS-122	A	45.4
Site 5	EFR	IN	7	LT14-1148	WHS-123	B	82
Site 5	EFR	IN	7	LT14-1149	WHS-124	C	111
Site 5	EFR	IN	7	LT14-1150	WHS-125	D	129
Site 5	EFR	IN	14	LT15-1175	WHS-157	A	76.8
Site 5	EFR	IN	14	LT15-1176	WHS-158	B	56.7
Site 5	EFR	IN	14	LT15-1177	WHS-159	C	92.4
Site 5	EFR	IN	14	LT15-1178	WHS-160	D	97.5
Site 5	EFR	IN	21	LT16-1203	WHS-201	A	57
Site 5	EFR	IN	21	LT16-1204	WHS-202	B	68.3
Site 5	EFR	IN	21	LT16-1205	WHS-203	C	66.4
Site 5	EFR	IN	21	LT16-1206	WHS-204	D	72.7
Site 5	EFR	OUT	0	LT11-1067	WHS-29	A	17.9
Site 5	EFR	OUT	0	LT11-1068	WHS-30	B	15.3
Site 5	EFR	OUT	0	LT11-1069	WHS-31	C	25.3
Site 5	EFR	OUT	0	LT11-1070	WHS-32	D	18.4
Site 5	EFR	OUT	1	LT12-1095	WHS-57	A	124
Site 5	EFR	OUT	1	LT12-1096	WHS-58	B	125
Site 5	EFR	OUT	1	LT12-1097	WHS-59	C	124
Site 5	EFR	OUT	1	LT12-1098	WHS-60	D	131
Site 5	EFR	OUT	3	LT13-1123	WHS-97	A	98.6
Site 5	EFR	OUT	3	LT13-1124	WHS-98	B	123
Site 5	EFR	OUT	3	LT13-1125	WHS-99	C	66.4
Site 5	EFR	OUT	3	LT13-1126	WHS-100	D	97.6

Appendix 11 (con't).

Study Site	Treatment	Location	Interval	Sample #	Lab #	Rep	Results (µg/spl)
Site 5	EFR	OUT	7	LT14-1151	WHS-126	A	41.5
Site 5	EFR	OUT	7	LT14-1152	WHS-127	B	61.4
Site 5	EFR	OUT	7	LT14-1153	WHS-128	C	65.8
Site 5	EFR	OUT	7	LT14-1154	WHS-129	D	40.7
Site 5	EFR	OUT	14	LT15-1179	WHS-161	A	40.1
Site 5	EFR	OUT	14	LT15-1180	WHS-162	B	40.1
Site 5	EFR	OUT	14	LT15-1181	WHS-163	C	33.7
Site 5	EFR	OUT	14	LT15-1182	WHS-164	D	28.9
Site 5	EFR	OUT	21	LT16-1207	WHS-205	A	15.4
Site 5	EFR	OUT	21	LT16-1208	WHS-206	B	10.7
Site 5	EFR	OUT	21	LT16-1209	WHS-207	C	14.3
Site 5	EFR	OUT	21	LT16-1210	WHS-208	D	14.7
Site 5	EHR	IN	0	LT11-1055	WHS-17	A	32.2
Site 5	EHR	IN	0	LT11-1056	WHS-18	B	33.2
Site 5	EHR	IN	0	LT11-1057	WHS-19	C	35.8
Site 5	EHR	IN	0	LT11-1058	WHS-20	D	24.5
Site 5	EHR	IN	1	LT12-1083	WHS-45	A	69.1
Site 5	EHR	IN	1	LT12-1084	WHS-46	B	63
Site 5	EHR	IN	1	LT12-1085	WHS-47	C	85.9
Site 5	EHR	IN	1	LT12-1086	WHS-48	D	48.7
Site 5	EHR	IN	3	LT13-1111	WHS-85	A	43
Site 5	EHR	IN	3	LT13-1112	WHS-86	B	51.7
Site 5	EHR	IN	3	LT13-1113	WHS-87	C	69.2
Site 5	EHR	IN	3	LT13-1114	WHS-88	D	57.2
Site 5	EHR	IN	7	LT14-1139	WHS-114	A	37
Site 5	EHR	IN	7	LT14-1140	WHS-115	B	42.2
Site 5	EHR	IN	7	LT14-1141	WHS-116	C	68.4
Site 5	EHR	IN	7	LT14-1142	WHS-117	D	55.5
Site 5	EHR	IN	14	LT15-1167	WHS-149	A	32
Site 5	EHR	IN	14	LT15-1168	WHS-150	B	33.4
Site 5	EHR	IN	14	LT15-1169	WHS-151	C	51.5
Site 5	EHR	IN	14	LT15-1170	WHS-152	D	36
Site 5	EHR	IN	21	LT16-1195	WHS-193	A	21.6
Site 5	EHR	IN	21	LT16-1196	WHS-194	B	25.9
Site 5	EHR	IN	21	LT16-1197	WHS-195	C	33.4
Site 5	EHR	IN	21	LT16-1198	WHS-196	D	32.7
Site 5	EHR	OUT	0	LT11-1059	WHS-21	A	8.02
Site 5	EHR	OUT	0	LT11-1060	WHS-22	B	8.01
Site 5	EHR	OUT	0	LT11-1061	WHS-23	C	11.4
Site 5	EHR	OUT	0	LT11-1062	WHS-24	D	8.7
Site 5	EHR	OUT	1	LT12-1087	WHS-49	A	37
Site 5	EHR	OUT	1	LT12-1088	WHS-50	B	43.7
Site 5	EHR	OUT	1	LT12-1089	WHS-51	C	51.7
Site 5	EHR	OUT	1	LT12-1090	WHS-52	D	32.8
Site 5	EHR	OUT	3	LT13-1115	WHS-89	A	31.6

Appendix 11 (con't).

Study Site	Treatment	Location	Interval	Sample #	Lab #	Rep	Results (µg/spl)
Site 5	EHR	OUT	3	LT13-1116	WHS-90	B	33.4
Site 5	EHR	OUT	3	LT13-1117	WHS-91	C	37.1
Site 5	EHR	OUT	3	LT13-1118	WHS-92	D	41.8
Site 5	EHR	OUT	7	LT14-1143	WHS-118	A	17.8
Site 5	EHR	OUT	7	LT14-1144	WHS-119	B	18.7
Site 5	EHR	OUT	7	LT14-1145	WHS-120	C	16.5
Site 5	EHR	OUT	7	LT14-1146	WHS-121	D	17
Site 5	EHR	OUT	14	LT15-1171	WHS-153	A	7.32
Site 5	EHR	OUT	14	LT15-1172	WHS-154	B	10.7
Site 5	EHR	OUT	14	LT15-1173	WHS-155	C	11.7
Site 5	EHR	OUT	14	LT15-1174	WHS-156	D	10.9
Site 5	EHR	OUT	21	LT16-1199	WHS-197	A	4.71
Site 5	EHR	OUT	21	LT16-1200	WHS-198	B	5.32
Site 5	EHR	OUT	21	LT16-1201	WHS-199	C	6.94
Site 5	EHR	OUT	21	LT16-1202	WHS-200	D	4.36

EHR = Electrostatic Half Rate EFR = Electrostatic Half Rate CFR = Conventional Full Rate
IN = Inside the canopy OUT = Outside the canopy
Interval = Days after pesticide application
Sample # = Worker Health and Safety identification number
Lab # = California Department of Food and Agriculture laboratory identification number
Rep = Replicate
Results of Analysis = Myclobutanil
ND = None detected