University of California Cooperative Extension Fresno County

Vine Lines

February 2009 Issue

Stephen J. Vasquez, Viticulture Farm Advisor

Reducing the Spread of Vine Mealybug by Managing Winery Waste

Rhonda Smith and Lucia Varela

Vine mealybug (VMB) infestations were first detected in North Coast vineyards in August 2002. Since that time, eradication efforts in known infested sites have increasingly given way to control measures including less disruptive insecticides, pheromone mating disruption and managing or augmenting natural enemies. An integrated approach to reduce the abundance of all types of mealybugs found in California vineyards should also include preventing human-assisted transport of these insects into new areas.

In 2003 and 2004 we investigated the survival of VMB on infested clusters that entered the winery as well as in pomace piles consisting of unfermented berry skins, seeds and stems. We wanted to learn if there was a risk of contaminating vineyards with VMB by spreading unfermented pomace, including stems, in vineyards. We learned VMB can survive pressures generated in whole cluster pressing, a process commonly used in white wine production. VMB can also survive in unmanaged pomace piles – piles that are later spread through vineyards.

We believed mealybugs could not survive fermentation so we focused our attention on VMB survival on clusters that were pressed and not in must. The two winery-cooperators in Sonoma County used bladder presses to process whole-cluster press loads. Pressure regimens varied by winemaker. In each of these wineries, when the press regimens were completed, unfermented skins, stems and seeds ("fresh pomace") were transported to a pomace holding area. It is common for these areas to also contain piles of stems (rachises), generated when

(Continued on page 2)

Drift Control—It's Up to You

Kurt Hembree

Establishing a grape vineyard and developing it into a healthy productive crop in the southern San Joaquin Valley is challenging. Cutting corners, even under difficult economic conditions, does not always prove fruitful. When it comes to herbicide use, spray application technique is one area you don't want to skimp on. Improper application procedures can lead to reduced weed control and unacceptable crop injury. Grapevines are very sensitive to a number of herbicides routinely used in vineyard plantings and/or surrounding crop and non-crop areas (table 1).

Since grapevines are actively growing for most of the season, potential exposure to off-target herbicide movement (drift) is high. Thus, it's important that herbicide treatments be made on time and on target. Steps taken to prevent herbicide drift, whether an application is made within the vineyard or in surrounding areas, will help protect grapevine health and productivity. The degree of crop injury varies when grapevines are exposed to herbicide drift. It can depend on type of herbicide, herbicide dose, age and health of the vines, when the vines are exposed to the herbicide, and other factors. Herbicide drift symptoms may range from slight yellowing (chlorosis) of the foliage, to malformation of leaves and fruit, to complete crop loss and plant death (photos 1–3). Damage may also result in reduced cane production for the following cropping cycle, and may be limited to a few vines or affect the entire vineyard.

(Continued on page 4)

(continued from page 1)

clusters of red grape varieties are processed by a destemmer-crusher. This gave us the opportunity to look at VMB survival in three different types of winery waste material: in pressed clusters, in fresh pomace piles and in piles of stems only.

Survival of VMB in Press Loads

A Bucher Press with a 150 hL capacity was used to process 6 tons of Grenache clusters infested with VMB. Prior to processing, VMB were counted on fifty randomly selected clusters. On average there were 107 insects per infested cluster (these clusters contained 1-2000 insects), and 44% of the clusters in the load were infested. A randomly selected cluster was placed in each of 50 mesh bags (approximately 7"L x 7.5"W). A second set of 50 mesh bags contained clusters that had visible insects. All bags were sewn shut and dropped into the press with the 6 ton load. After an approximately 4 hour press regimen that gradually increased pressure to 1.8 bars, the bags were retrieved along with several pounds of pomace.

The contents of each bag were placed on a sticky card and insects that moved off the cluster onto the card were counted. Clusters were placed on fresh cards to continue counting insects over several weeks until no insects were counted over a 2 week period. The 1400 pressed clusters were handled in a similar manner but in groups of clusters.

In bags containing 100% infested clusters 0.04 ± 0.20 insects survived per cluster. Adjusting this number to account for the actual incidence of VMB in the load (44%), the survival in the bags was similar to that of the survival in the loose pomace (0.02 ± 0.06). In summary, on average two insects per 100 cluster stems survived the press.

Although 2 insects survived per 100 cluster stems on loose pomace, no insect survived in the 50 bags where the clusters were selected at random. This led us to believe that the bags may have affected insect mortality. To address this concern, we conducted a second press load trial.

To a 12-ton uninfested load of Chardonnay, we added 100 mesh bags of VMB infested clusters. Each bag contained either a stem only, a stem with detached berries, or a whole cluster. The press regimen reached a maximum of 1.6 bars over a 3 hour period. Insects survived in all bags regardless of the contents of the bags. VMB survival in bags containing either a whole cluster or a stem only was 4 % and 23% respectively. Survival in bags containing a stem with detached berries was intermediate at 10%. We concluded that although the bags may have affected mortality, insects did survive whole cluster pressing even under challenging (bagged) conditions.

Survival of VMB in Pomace and Stem Piles

VMB survival was evaluated in two types of winery waste piles. Two experiments were performed utilizing round piles of pomace including stems and a single windrow containing only stems.

Round Piles

Four truckloads containing a mixture of pomace and stems from whole cluster press loads of white grapes were dumped separately. Each load was divided into two equal-sized piles to achieve pairs of piles with a similar mixture of stems, skins and seeds. This produced 4 pairs of piles, each pile approximately 4-feet tall and 15-feet across. One pair contained mostly stems and the other three pairs consisted mostly of skins and seeds. Within each pair of piles, one was covered with 4mil thick clear plastic and the other remained uncovered.

Four mesh bags each containing infested stems and a temperature logger were placed at two different depths in the center of each pile for a total of 8 bags per pile. VMB were counted on stems collected from the same source that provided infested stems which were placed in bags. Each stem contained an average of 1,211 VMB. Every week, for 4 weeks, one bag from each depth per pile was removed. Stems were placed on sticky cards and moved to clean cards every week to count VMB as previously described.

Covered Round Piles

In the covered piles VMB population reduction ranged between 99.9 to 100%, regardless of the position of the bag in the pile, the week it was removed or pile composition (Table 1). Temperature in the mostly stems covered pile fluctuated daily between 68 and 130 ºF. In mostly skins and seeds covered piles, temperatures rose in the first few days to 100ºF and then slowly increased to 120 to 130ºF in the following 4 weeks.

(Continued on page 3)

Managing Winery Waste

(continued from page 2)

Uncovered Round Piles

In the mostly stems uncovered pile we obtained the lowest VMB reduction, ranging from 61 % after one week to 89 % after four weeks (Table 1). In this pile, temperatures fluctuated almost daily between approximately 55 and 85 ºF. In the uncovered mostly skins and seeds piles VMB reduction ranged from 99.9 to 100 %. In these piles, temperatures fluctuated for the first two weeks and in most cases, remained above 100ºF for the following two weeks.

Windrow of Stems.

Several truckloads of cluster stems of red grape varieties collected from the destemmer were used to create an east-west oriented windrow 4-feet tall, 80-feet long and 15-feet wide. The windrow was divided into eight, 10-foot sections. A total of 32 mesh bags were each filled with 5 infested stems and sewn shut. In the center of each windrow section four bags were placed at a 2-foot depth. Starting from the west end, a 10-foot section was covered with 4 mil clear plastic and the adjacent section remained uncovered. This pattern was continued to create four covered and uncovered sections. Three covered sections had plastic across the top and sides, while the west end had plastic on three sides and the top. Each week, for four weeks, one bag was removed from each section and the contents placed on sticky cards to count surviving VMB.

The greatest population decrease occurred in the west end where plastic covered three sides and the top of the windrow. In all remaining sections, there was a reduction in the number of VMB through time but there was no significant difference between VMB survival in the sections covered on both sides and top and the uncovered sections. Temperatures in the uncovered sections closely followed ambient air temperatures. Temperatures in the covered sections fluctuated less and remained cooler than the uncovered sections. The plastic was not effective at raising internal temperatures because air flux occurred between covered and uncovered sections.

Conclusions

Vine mealybugs survived whole cluster pressing in these experiments with approximately 2 live insects for every 100 bunch stems unloaded from the press. Although this reduction from 107 insects per cluster is substantial, fresh pomace or cluster stems should not be spread directly into vineyard middles given the large numbers of clusters processed by wineries. Instead, this material should be covered for at least one week with thick, clear plastic that is secured at the bottom to prevent air flow and increase pile temperatures. If possible, pomace and stems should be mixed to avoid "stemmy" piles that generate less heat when covered than piles with skins and seeds.

Rhonda Smith is a Viticulture Advisor in Sonoma County and Lucia Varela in an IPM Advisor in the North Coast Region.

Table 1. Reduction of VMB on cluster stems after 1 and 4 weeks in two depths, in covered and uncovered pomace piles.

Treatment	Pile composition	Infested stem position in pile	Reduction in vine mealybugs/cluster Week 1	Week 4
			%	
Uncovered piles	Mostly stems	Top	67.6	89.4
		Bottom	60.7	87.5
	Mostly skins and seeds; few stems	Top	99.9	>99.9
		Bottom	99.9	100
Covered piles	Mostly stems	Top	>99.9	100
		Bottom	100	100
	Mostly skins and seeds; few stems	Top	100	100
		Bottom	>99.9	>99.9

Drift Control

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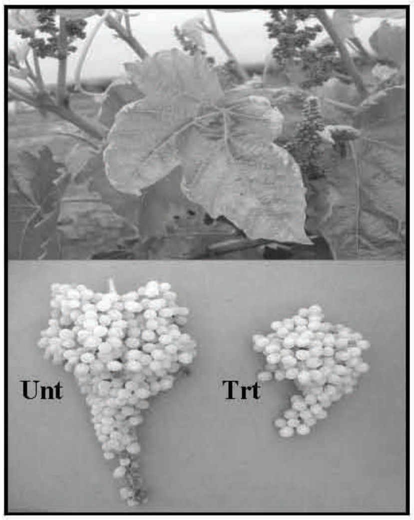

Photo 1. Glyphosate damage

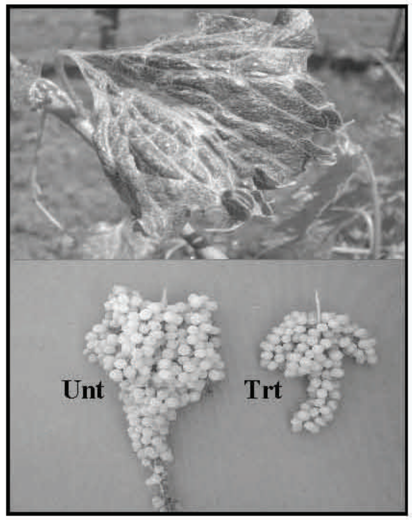

Photo 2. 2,4-D damage

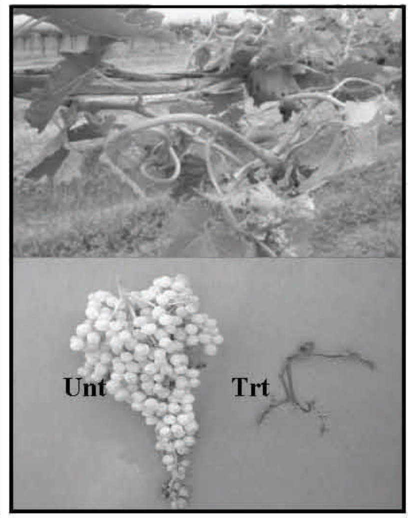

Photo 3. Glyphosate + 2, 4-D damage

When grapevines are dormant during winter, they are generally less susceptible to injury from herbicide drift. Dormancy lasts only a few months, so the window of opportunity to treat for weeds and reducing risk of crop injury is narrow. It's important to take advantage of pre- and postemergent herbicides during this period to help reduce the weed population and spray trips needed in-season, when grapevines are more susceptible to damage. Regardless of when spraying occurs, be aware of your surroundings and keep the spray mix targeted at the weeds.

The goal of applying herbicides is to maximize the amount of herbicide reaching the target weeds and minimize the amount reaching off-target sites (like your grapevines). Proper application procedures will result in maximum herbicide performance and reduced crop injury. Spray drift occurs as a result of the movement of herbicide from the target area to areas where herbicide application is not intended. The primary means of spray drift injury occurs when spray droplets are carried from the application site downwind and deposited on a sensitive plant surface, like buds, leaves, shoots, etc. Although less likely to occur, spray drift can be the result of vapor drift (evaporation of an herbicide from a plant surface) and particle drift (spray carrier droplets evaporate, leaving concentrated herbicide droplets).

Spray drift is influenced mainly by droplet size (figures 1 and 2) and environmental conditions during application (figure 3). High wind, low humidity, and high temperature favor drift potential. Spray droplets with a mean diameter of <200 microns are the most susceptible to drift. Droplets this size are about the same size as sewing thread. In general, the longer spray droplets remain airborne, the greater the chances they are going to be carried by wind away from the application site (figure 4).

(Continued on page 5)

Table 1. Herbicides with postemergent activities that can potentially injure grapevines.

Plant Growth Regulators	Amino Acid Inhibitors	Cell Membrane Disruptors
2, 4-D (DriClean,® etc,)	glyphosate (Roundup®, etc.)	paraquat (Gramoxone®)
MCPA	glufosinate (Rely 200®)	carfentrazone (Shark®)
dicamba (Banvel®, etc.)	imazethapyr (Pursuit®)	flumioxazin (Chateau®)
triclopyr (Garlon®,etc.)	imazamox (Raptor®)	oxyfluorfen (Goal®)
clopyralid (Transline®, etc.)	pyithiobac (Staple®)	Pyraflufen (Venue®)
Aminopyralid (Milestone®, etc.)	halosulfuron (Sandea®)	Bromoxynil (Buctril®)

Note: This is not a complete list of herbicides that injure grapes.

Drift Control

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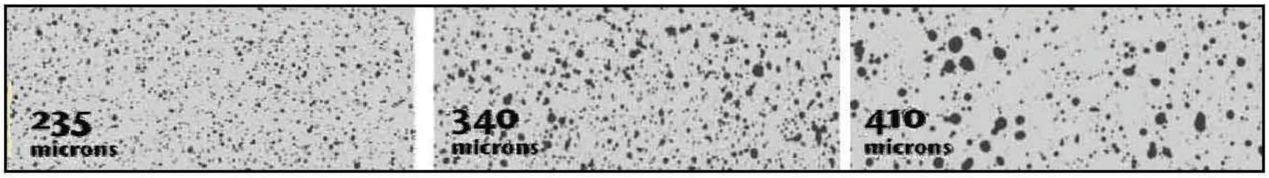

Figure 1. Relative droplet size and distribution on water sensitive paper.

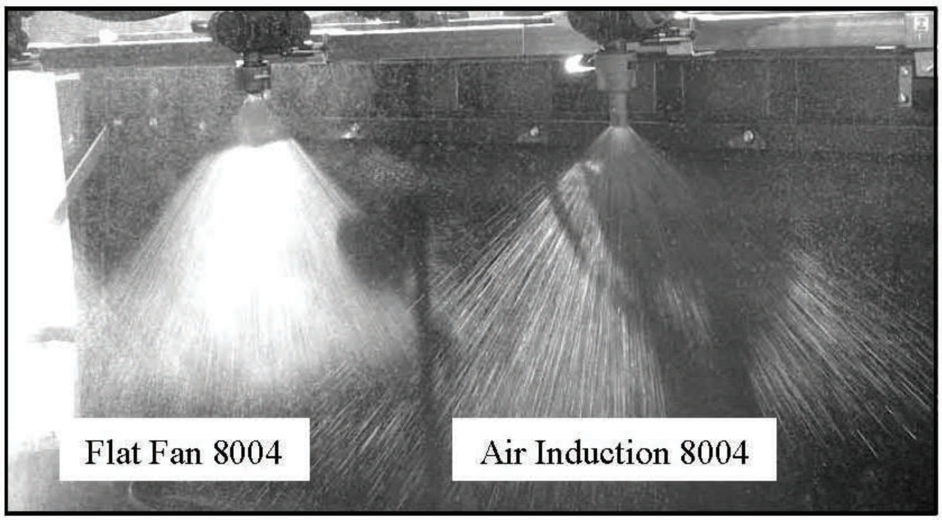

Figure 2. Relative droplet size from two nozzle types at 40 psi.

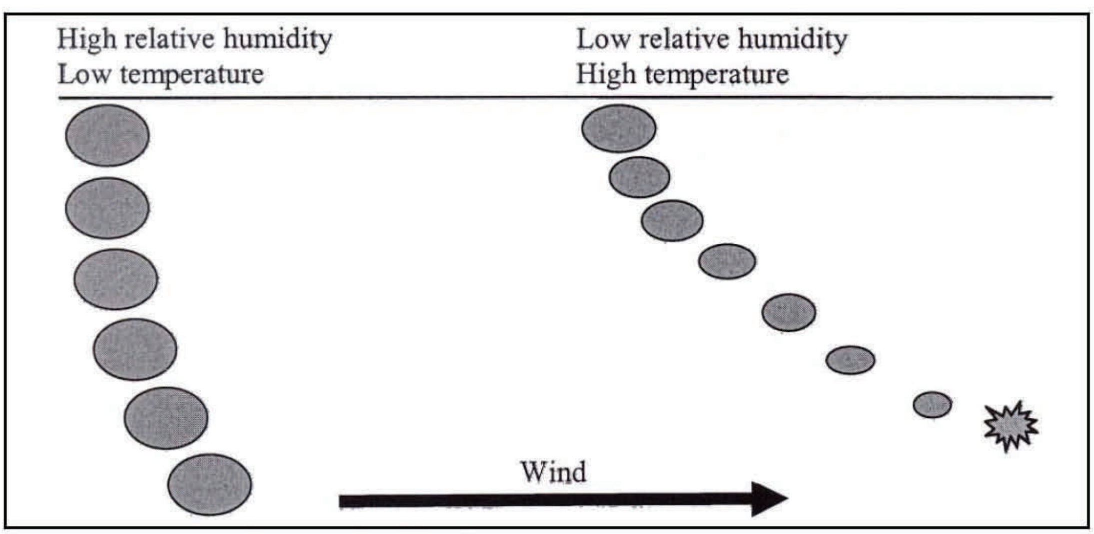

Figure 3. Influence of wind, temperature, and relative humidity on spray droplet drift.

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Drift Control

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Small droplets are more susceptible to drift than larger droplets, because they are lighter and tend to remain airborne longer than the larger droplets. In addition to droplet size, the height of the sprayer boom will influence the distance spray droplets may travel from the application site (figure 5). The influence of important environmental and spray conditions on drift potential are shown in table 2.

Selecting the appropriate spray equipment and using good application techniques will reduce the risk of spray drift and crop injury. To reduce drift and achieve maximum herbicide efficacy at the same time, consideration must be given to several important parameters before making herbicide applications. Items to consider before spraying include: label instructions, environmental conditions, buffer zones, the sprayer, application timing, nozzle selection and spray pressure, boom and nozzle height, travel speed, and spray additives.

1. *Label Instructions* – Always read and follow label directions before treating weeds. Information printed on the label describes ways for you to achieve maximum herbicide performance, reduce drift, and prevent crop injury.

2. *Environmental Conditions* - Don't spray when winds are above 7 mph (unless appropriate spray shields are used). Many herbicides become volatile at temperatures above 80 °F. If temperatures are predicted to be high, consider spraying towards the end of the day as it begins to cool. Avoid using "ester" formulations of herbicides (limited primarily to certain 2,4-D formulations), as they are very volatile under warm conditions. On foggy days or when the air is still, small droplets or "fines" can remain suspended in the air a long time, so be cautious under such conditions.

3. *Buffer Zones* – Refer to the product label to determine adequate buffer zones outside of the field being treated. Do not spray if the wind is blowing towards a nearby sensitive crop, garden, waterway, or other sensitive area.

4. *The Sprayer* – Sprayers designed to apply herbicides at low volumes (<5 gpa) produce very fine droplets (<100 microns) and can drift long distances. In most cases, spray shields are attached to the boom and operate close to the weed canopy to reduce the risk of drift. An example of such a sprayer is the Enviromist®, but others are also available. There are numerous types of conventional boom sprayers available. Sprayer selection should be selected based, not only on the ability to deliver product and reduce drift, but meets other important needs (cost, tank capacity, speed, etc.). Using shields over spray booms and nozzle bodies will help reduce risk of drift from 35 to 75%. Routine sprayer maintenance and accurate sprayer calibration is required for efficient use of herbicide products, time, and labor.

5. *Application Timing* – Always apply herbicides based on the target weed stage according to label directions. Never forget to consider the stage of growth of the grapevines before spraying. Vines that are showing signs of bud swell are extremely sensitive to postemergent herbicides. Swelling buds act like little sponges that can readily absorb herbicides deposited from spray drift. Treating small weeds (<4" tall) will allow you to lower the boom and greatly reduce the risk of drift. Raising spray booms or angling spray nozzles more upright to compensate for larger weeds, increases the risk of spray drift.

6. *Nozzle Selection and Spray Pressure* – Use spray nozzles with an orifice size of >02 that operate at a pressure of 15 to 40 psi. Excessive spray pressure creates fine droplets prone to drift. Use a minimum of 10 gal/acre, unless otherwise specified on the label. TeeJet® brand nozzles are the most widely used and readily available (figures 6–8). For vineyards, standard flat fan nozzles work fine for preemergent applications, but are not well suited for postemergent sprays. Instead, consider using an "Extended Range" type nozzle, which can produce different droplet sizes under different operating pressures. You can adjust the spray pressure based on the type of herbicide used to maximize performance and reduce drift. For example, operating an XR10003VS nozzle at 3 mph and 20 psi will deliver about 18 GPA of medium-sized droplets (excellent for systemic-type herbicides like Roundup®).

(Continued on page 7)

Drift Control

(continued from page 6)

Operating the same nozzle at 30 psi will deliver about 26 GPA of fine-sized droplets (excellent for contact-type herbicides (like Gramoxone®). Rather than cranking up the spray pressure to achieve larger volumes of water (and more drift), select larger nozzle sizes if more volume is desired. Nozzles designed to produce coarse droplets and reduce drift are also available, including Drift Guard, Air Induction, and others. In most cases, these types of nozzles can reduce drift by 50 to 95%. Always refer to the spray nozzle owner's manual for recommended nozzle uses.

7. *Boom and Nozzle Height* – Operate nozzles at their lowest recommended height. For 80° tips, this is 18", and for 110° tips, this is 12". Orienting nozzles forward allows for further height reductions. Treat small weeds so the spray boom is not raised too high.

8. *Travel Speed* – Travel speeds above 6 mph can create a wind-sheer effect on the spray pattern. At these speeds, spray droplets can be sheered, leading to increased risk of drift. For most vineyard weed applications, a travel speed of 3 to 4 mph is adequate. The close row spacing and trellis systems used in vineyard production often limits the sprayer travel speed due to worker safety concerns.

9. *Spray Additives* – Spray additives, like ammonium sulfate, can improve efficacy of postemergent sprays, but can also thicken and/or alter the spray's viscosity.

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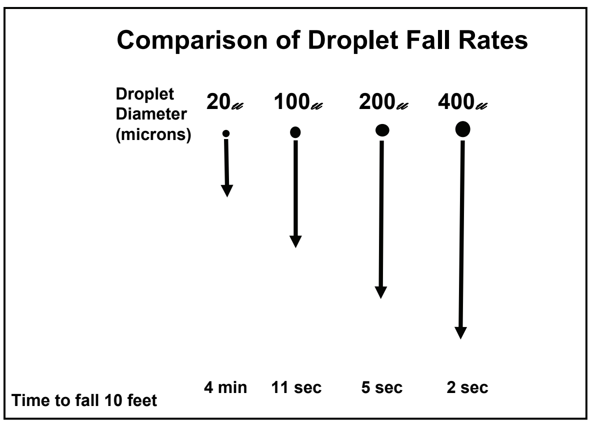

Figure 4. Droplet fall rates.
Ohio State University Extension

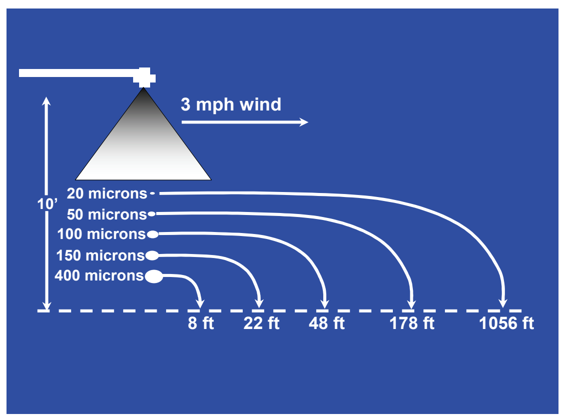

Figure 5. Boom height and droplet travel distance. Ohio State University Extension

Table 2. Environmental and spray conditions that influence spray drift.

Factor	More Drift	Less Drift
Spray particle size	Smaller	Larger
Wind Speed	Higher	Lower
Air temperature	Higher	Lower
Relative humidity	Lower	Higher
Air stability	Vertically stable	Vertical movement
Herbicide volatility	Volatile	Non-volatile
Nozzle orifice size	Smaller	Larger
Nozzle type	Produce fine droplets	Produce coarse droplets
Spray pressure	Higher	Lower
Spray release height	Higher	Lower

Drift Control

(continued from page 7)

Additions like this to the spray tank may alter droplet size and reduce flow rate. Checking the spray droplet pattern on water sensitive paper, before adding the herbicide(s) to the tank, will readily show if the droplet size is acceptable to you. Adding spray drift retardants can also be used to reduce drift by up to 95%. Always refer to the label for mixing directions when using spray additives and spray drift retardants.

Herbicide performance clearly isn't based on the herbicide product alone. In fact, many factors must be considered to maximize herbicide performance. Protecting your grapevines (or any desired plants) from possible herbicide drift injury must always be considered when treating for weeds in or near your vineyard. Reading and following the herbicide label closely, using appropriate spray equipment, nozzles, and application procedures, and applying treatments under favorable environmental conditions will help reduce spray drift and ensure cost-effective weed control and crop safety.

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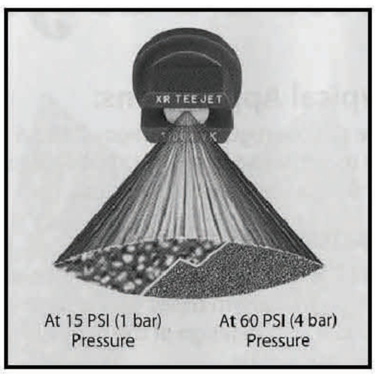

Figure 6. Extended Range

Figure 7. Air Introduction

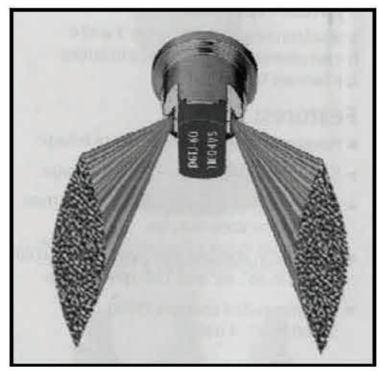

Figure 8. Drift Guard TwinJet

UC GRAPE DAY

August 11, 2009

7:00 a.m.—12:00 pm
Kearney Agricultural Center

9240 S. Riverbend Ave.
Parlier, CA 93648

Calendar of Events

Local Meetings and Events

UC Grape Day
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7:00 a.m.—12:00 pm
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Parlier, CA 93648

U.C. Davis University Extension Meetings

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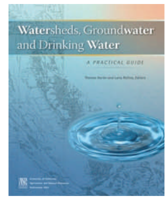
Introduction to Wine Analysis: Small Scale
February 7, 2009
8:00 a.m. — 6:00 p.m.
1127 North Mondavi Institute for Wine and Food
Old Davis Rd.
Davis, CA
Instructor: Michael Ramsey
Section: 083VIT204

Varietal Winegrape Production Short Course
February 24-26, 2009
8:30 a.m.— 5:00 p.m.
Freeborn Hall, North Quad
Davis, CA
Instructor: UC Faculty
Section: 083VIT200

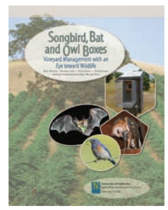
Introduction to Wine Analysis for Professional Winemakers and Winery Lab Workers
March 14, 2009
8:00 a.m.— 6:00 p.m.
1127 RMI North, Robert Mondavi Institute for Wine & Food, Old Davis Rd,
Davis, CA
Instructor: Michael Ramsey
Section: 083VIT203

Publications from the University of California



Watersheds, Groundwater and Drinking Water: A Practical Guide
ANR Publication 3497
Price - $40.00 + tax and shipping

This handy guide is a "must-have" for environmental scientists, water technicians, educators, and students. Water shed and groundwater hydrology fundamentals are discussed.



Songbird, Bat, and Owl Nest Boxes
ANR Publication 21636
Price - $15.00 + tax and shipping

This guide explains the benefits of the biodiversity and aesthetics of songbirds, bats and owls. Methods on how to integrate nest boxes within a vineyard are discussed.

Order Form

Publication	Qty.	Price	Subtotal
Watersheds Guide		$ 40.00	
Songbird, Owl Boxes		$ 15.00	

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Vine Lines

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