University of California Cooperative Extension Fresno County

Vine Lines

Stephen J. Vasquez, Viticulture Farm Advisor

Managing Nematodes in Grape Production Systems

Becky Westerdahl

Plant parasitic nematodes, non-segmented, microscopic roundworms, are a factor that should be considered by a grower planning to plant a vineyard. If the vineyard site is not infested, a grower should be aware of techniques to prevent the introduction of harmful species. If a vineyard is to be planted in a nematode infested area, a grower should develop both pre and post-plant management strategies

To develop a nematode management program, growers need to be familiar with the following: nematode biology and population dynamics; pathogenicity; symptoms and signs of nematode damage; sampling techniques; and the principles underlying various management techniques (such as planting site selection, the use of certified nursery stock, the use of clean equipment and irrigation water, rootstock characteristics, the use of fallow, cover crops and soil amendments and the principles of pre-plant fumigation).

Biology and Population Dynamics

Nematodes are aquatic animals that live in a variety of habitats including soil, fresh and saltwater, within plants, and within both vertebrate and invertebrate animals. Those living within plants and animals (e.g. hookworms, pin worms, dog heartworm, and Ascarid worms) may become damaging if their population level gets too high. Other nematode species such as those feeding on weeds, insects or decaying plants are considered to be beneficial to man and the environment.

The nematodes that parasitize and damage vineyards are less than one tenth of an inch long and are found either in soil or within roots. Within the soil, they live and move within the film of water which lines soil pore spaces. They are small enough to move

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New Online Registry Offers One-Stop Shopping for Grape Varieties

From Aligoté to Zinfandel, a listing of grape varieties and where they can be obtained throughout the United States is now available at a new Web site designed to help grape growers and researchers find appropriate grape plants.

This new National Grape Registry, developed and maintained at UC Davis, is intended to be a user-friendly source for all grape plant material available in the United States, including wine, table, juice and raisin grapes, as well as grape rootstock. It can be found online at http://ngr.ucdavis.edu/. "The main emphasis of the site is to help growers, nurseries, winemakers and researchers find the plant material they need," said Deborah Golino, director of Foundation Plant Services at UC Davis. "We hope the site will make it easier to find domestic sources for diverse grape varieties and clones, and to identify plant material that has been tested and certified as free of certain grapevine diseases."

She noted that quarantine regulations and the high cost of

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Managing Nematodes

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between individual soil particles. It is not uncommon for a single teaspoon of soil from a vineyard to contain 50 nematodes or for a single inch of feeder root to contain 200.

Nematodes have a relatively simple body structure. When viewed under a microscope, the external covering or cuticle is transparent permitting the viewing of major organs such as the digestive tract and reproductive system. They possess a spear or stylet which is used to pierce and feed on plant tissues.

Of the many genera of plant parasitic nematodes detected in soils from California vineyards, root knot (*Meloidogyne* sp.), dagger (*Xiphinema index*, *X. americanum* and *X. americanum* like sp.), citrus (*Tylenchulus semipenetrans*), lesion (*Pratylenchus vulnus*), and ring (*Mesocriconema xenoplax*) nematodes are the most important ones. Other nematodes associated with grape in California include stubby root nematode (*Paratrichodorus minor*), spiral nematode (*Helicotylencus pseudorobustus*), and needle nematode (*Longidorus africanus*). Of these, only needle nematode has been found to be damaging to grapes in California. Pin nematode (*Paratylenchus hamatus*), is frequently found in vineyards but is not thought to cause damage to this crop. Dagger, ring, and lesion nematodes are most prevalent in north and Central Coast vineyards, and in the San Joaquin Valley. Root knot and citrus nematodes occur most commonly in the San Joaquin Valley, and southern California. The needle nematode is found mainly in southern California. Species introduction, native habitat, soil texture, grape cultivar, cropping history, weed spectrum, and growing region are the determining factors as to which nematode is present in which vineyard.

The common names of nematodes are derived either from the morphology of the nematodes or from damage seen on crops. For example, the cuticle of ring nematodes has prominent striations or rings, the stylet of dagger nematodes is very long and prominent, and pin nematodes are among the smallest plant parasitic nematodes. Root lesion nematodes get their name from the lesions that can sometimes be found on roots in which they have been living. The common name of root-knot nematode is derived from the galls or knots which are visible on roots.

Plant parasitic nematodes exhibit several different life history patterns. Ring nematode is a sedentary ectoparasite, whereas dagger nematodes are migratory ectoparasites. Although these nematodes use stylets to feed on roots, all stages of their life cycle are passed outside of roots in the soil. Root lesion nematodes are migratory endoparasites and life cycle stages may be found within roots as well as soil. Root knot nematodes are sedentary endoparasites. The second stage juvenile enters a root, takes up a permanent feeding site and then develops to an immobile adult female within the root. The root cells around her head enlarge to form a gall or knot. Knowledge of these life history patterns can be helpful when making management decisions. For example, some nematicides, parasites, or soil amendments can be expected to be active only in the soil and so would be more effective against ectoparasites than endoparasites. Other nematicidal agents might move systemically through a root or parasites might be able to penetrate roots and actively seek out nematodes and would then be effective against endoparasites.

The nematode life cycle consists of an egg stage, four gradually enlarging juvenile stages, and an adult stage. The length of a single generation varies depending on the species, the soil temperature, and other factors. Under optimum conditions (approximately 65-85 F) four to eight weeks are required for one generation of root lesion, ring, pin, or root knot nematodes. In most grape growing areas, there can be several generations of these parasites each year. Dagger nematodes, on the other hand, may require a full year. Adult females of all these nematodes can lay several hundred to a thousand eggs apiece. Nematode population levels in vineyards fluctuate during the year. Knowledge of nematode population dynamics is valuable to a grower contemplating a management technique expected to reduce the numbers of nematodes present in a vineyard. For example, if a grower were to determine the population level of *X. index* in winter, and then again the following summer, a population reduction would likely be found whether or not any treatment had been used. A better approach is to leave some vines untreated and

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then compare populations in treated and untreated areas on the same day both before and after the application. Conversely, an application conducted in summer (when *X. index* populations are typically at their lowest) and sampled in the winter (when populations should be highest) would appear not to have been effective unless untreated vines were available for comparison. For a variety of reasons, anyone intending to test the nematode control value of a particular treatment should be prepared to take a number of soil or root samples.

Pathogenicity

It is common for one vineyard to have several species present. Plant parasitic nematodes feed on roots, reducing vigor and yield of the vine usually in irregular patterns across the vineyard. Damage patterns are frequently associated with soil textural differences. Root-knot nematodes penetrate into roots and induce giant cell formation, usually resulting in root galls. Giant cells and galls disrupt uptake of nutrients and water, and interfere with plant growth. *X. americanum*, the most common species of dagger nematode, weakens vines by feeding near the root tip and is a specific vector of yellow vein virus (also known as tomato ringspot virus). The dagger nematode, *X. index*, can cause yield reduction in some varieties, but is more important for its transmission of grapevine fanleaf virus. Both ring and dagger nematodes feed from outside the roots, but can reach the vascular tissues with their long stylet. Root lesion nematode restricts the growth of roots as it feeds and migrates in and out of roots; it can be especially damaging to newly planted vines. Citrus nematodes establish feeding sites with their heads embedded in cortical tissue and their posterior ends outside the roots. Their feeding disrupts the uptake of nutrients and water, and interferes with plant growth.

Nematodes do not typically kill vines. They are plant stressors and act in conjunction with other stress factors in vineyards to reduce growth and yields. Penetration and movement by nematodes through plant tissues results in mechanical injury to cells and subsequent cell death and necrosis. Mechanical injury interrupts the uptake and flow of water and nutrients from roots and the flow of food from leaves to roots. In addition, nematodes create openings in roots through which other microorganisms can enter. All of the above increase the susceptibility of vineyards to environmental stress. Because we are dealing with field situations in which other stress factors than nematodes are present, it is difficult to develop precise measurements of the amount of yield and growth reduction caused by nematodes in established vineyards. Increases in growth and in yield have been demonstrated following the application of nematicides in field experiments and subsequent reductions of populations. Interpreting the results of experiments such as these is not as straightforward as might first appear. The nematicides used could have activity against other organisms as well, and some nematicides have been shown to stimulate growth of plants that have not been infested with nematodes. The rootstock utilized has some bearing on nematode pathogenicity. When discussing the merits of different rootstocks, it is important to understand the terminology used by nematologists. Immune plants do not allow nematode feeding. Resistant or nonhost plants may be invaded by nematodes and may show damage, but chemical or physical unsuitability of the plant will prevent or greatly limit nematode reproduction. Susceptible or host plants allow normal nematode reproduction and may or may not tolerate nematode attack. Among susceptible plants, tolerant hosts are able to withstand nematode feeding and penetration. Intolerant susceptible hosts will be damaged by nematodes. The degree of tolerance can be greatly influenced by environmental conditions. For example, populations of ring nematode are typically higher in coarse textured (sandy) soil than in finer textured soils.

Symptoms and Signs of Nematodes

Within vineyards, there are no distinctive symptoms or signs of nematode damage. If a previous vineyard had problems with one of the nematodes previously listed as causing problems, it is highly likely that a subsequent vineyard will also have problems. The symptoms described below are indicative of a nematode problem, but are not diagnostic as they could result from other causes as well. Generally, nematode infestations result in areas of the vineyard

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with vines that lack vigor and have restricted growth and reduced yields. Root-knot nematodes produce small galls on the roots (about 0.125 inch in diameter), but they can be larger when multiple infections cause galls to coalesce. The dagger nematode, *X. index*, feeds on root tips causing them to swell in a manner similar to the nodosities caused by phylloxera. Virus transmission by dagger nematode produces symptoms on leaves such as yellowing of veins, mosaic, and malformation with symptom expression less apparent among white varieties and in warmer regions. Infestation by root lesion nematode restricts top growth of young vines. If young vines are planted in soil infested with lesion nematode, root systems may be severely restricted and sometimes exhibit brown lesions. Soil adheres to roots infested with citrus nematode giving them a dirty appearance. Ring nematodes cause general aboveground lack of vigor and reduced vine growth and yields.

Sampling for Nematodes

To make management decisions, it is important to know the nematode species present and to estimate their population. If a previous orchard or vineyard had problems caused by nematodes that are also listed as pests of grape, population levels may be high enough to cause damage to the young vines. If nematode species have not previously been identified, take soil samples and send them to a diagnostic laboratory for identification. Take soil samples from the berm area 12 to 18 inches from the vine trunk to a depth of about 30 inches. Include some feeder roots in the sample. Divide the vineyard into sampling blocks that are representative of cropping history, crop injury, or soil texture. Take samples of soil and symptomatic roots from around five randomly chosen vines per block, mix them thoroughly, and make a composite sample of about 1 quart (1 liter) for each block. Place the samples in separate plastic bags, seal them, and place a label on the outside with your name, address, location, the previous crop/variety, and the current variety grown or that you intend to grow. (See UC/ANR Publication 3343, Grape Pest Management, 2nd edition, for more details). Keep samples cool (do not freeze), and transport as soon as possible to a diagnostic laboratory. If dagger nematode is found to be present, ask to be told if the species is *X. index*. Because a number of different species of root lesion nematode (only one of which is known to be pathogenic to vines) could be found in a sampling site, request a species diagnosis if root lesion nematode is found. Contact your farm advisor for more details about sampling, to help you find a laboratory for extracting and identifying nematodes, and for help in interpreting sample results. During recent years, increasing emphasis has been placed on the development and use of damage thresholds for making management decisions for aboveground pests. For many reasons, it is difficult to establish damage thresholds for nematodes. These include difficulties in obtaining representative samples and variability in extraction methods and efficiencies of different laboratories as well as the many biotic and abiotic factors that influence populations. However, a routine soil sampling program can be very helpful in establishing the need for, and the success of a nematode management program. If the nematodes discussed above as pathogens are present in a vineyard with below normal growth and yield, and no other explanation of the problem can be found, it is likely they are contributing to the problem. In order to determine if the nematode population is increasing or is remaining stable, a grower should sample an infested vineyard at least once a year and at the same time each year. If one wants to evaluate the benefits of a management technique, it is essential to leave some vines untreated in order to establish the effectiveness of the technique with respect to nematode control and crop production.

Management Techniques

Selection of Planting Site

Whenever possible, a vineyard should be planted on land that has not previously been planted to woody crops or has at least been in annual crops for several years. The annual crop site may contain the same nematode species as an old orchard or vineyard site, but fleshy crop roots rot more quickly than woody ones, leaving the nematodes unprotected in the soil.

Certified Planting Stock

Rootstocks certified by a regulatory agency to be free of nematodes should be used to minimize the chance of contaminating previously uninfested land or of adding nematodes to soil which has

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been treated to reduce nematode populations prior to planting.

Clean Equipment

To minimize transfer of plant parasitic nematodes, water should be used to remove soil from farm equipment prior to moving equipment between vineyards.

Irrigation Water

Although growers might not have a choice of sources for irrigation water, they should be aware that surface irrigation water has been shown to be a potential source of nematode contamination. Whether or not there is a serious potential for contaminating vineyards from irrigation water has not been determined. However, it is clear that one should not use runoff water from a vineyard known to be infested with nematodes to irrigate an uncontaminated vineyard. If a serious contamination problem is suspected, settling ponds can be used to remove inoculum.

Choice of Rootstock

A number of factors in addition to nematodes should be considered when choosing a rootstock. For root-knot, no single rootstock is resistant to all species and there are numerous other nematodes of concern. Broadest resistance is present in Ramsey, Freedom, and several rootstocks in the Teleki series (5C is the only one that has been specifically tested). Rootstocks are available with tolerance to *X. index*. Researchers are actively working to develop new rootstocks with resistance or tolerance to multiple species and genera of nematodes, and new ones are released periodically. Consult your farm advisor for the appropriate site selection and cultural practices associated with each rootstock.

Fallow

The length of time that many nematodes can survive in weed free fallow soil is not known. To naturally rid an old vineyard site of the effects of *X. index* and grapevine fanleaf virus, it is necessary to forgo planting grapes for more than 10 years. This period of time is required to allow old roots to decompose and nematode numbers to decrease. This will increase the length of time before a new vineyard exhibits virus symptoms, but will not prevent reinfestation. Do not rotate sites with crops or plant cover crops that are hosts to nematodes. Root-knot nematode populations are likely to decrease by 80 to 90 percent within a year's time. Until host roots from a previous crop have rotted, they could continue to support nematodes.

Cover Crops

Interplanting cover crops in vineyards can be beneficial for a number of reasons including: (1) reducing erosion, (2) adding organic matter and nitrogen to the soil, and (3) providing protection for beneficial insects. However, growing cover crops may interfere with other management practices and should first be tried on a small scale. From the standpoint of nematode management, it is desirable to choose a cover crop that will not support nematode reproduction or may even be antagonistic to nematodes. As stressed previously, it is important to know which species are present in a vineyard. If two or more species of nematodes are present, finding a nonhost cover crop becomes more difficult than if only a single species is present.

Biological Control

Many soils contain predators and parasites of nematodes which may result in some level of natural biological control. There are no registered microbial nematicides.

Amendments

The addition of amendments to soil such as green manure, chitin, sesame chaff, animal manure, humic acid, organic fertilizer, compost and/or proprietary mixtures of beneficial microbials is generally proclaimed to be beneficial to plant growth. With respect to nematode management, such benefits may include: (1) stimulation of the growth of nematophagous fungi that may be present; (2) improvements in soil structure, in water retention, and in plant nutrition which would reduce stress on nematode infested plants; and (3) production of nematicidal breakdown products. Because of the complex nature of the interactions that may occur, interpretation of results following addition of soil amendments is difficult. Nematodes reside as deep in soil as do vineyard roots. The application of an amendment is seldom deeper than four inches meaning that nematicidal benefit must some how be delivered another three to four feet deeper. If these amendments have value it could show up by using them preplant in backhoe sites. Sufficient data is not available to predict with any certainty the nematode mortality or yield

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that might be obtained with these materials. In some cases, the addition of amendments has resulted in phytotoxicity on some crops. As stressed above, leaving untreated areas for comparison is the best method for judging the success or failure of soil amendments.

Preplant Nematicides

Telone II (1,3-dichloropropene), Enzone (sodium tetrathiocarbonate), and metam sodium are available for preplant use in California. Fumigants move through the air in the soil pores and then dissolve in the film of water surrounding the pores to reach nematodes. Because of the physical properties of the registered products, following proper soil preparation, Telone II can be expected to move deeper into the soil through air in the soil pores than the other two products. Enzone and metam sodium should be applied in irrigation water sufficient to reach the depth to which control is desired.

Nematicides will not eradicate nematodes from soil. Properly conducted applications will allow as much as six years for healthy root system development before nematode populations increase to damaging levels. Label usage recommendations should be precisely followed in all respects. Planting too soon after application can result in phytotoxicity. Mycorrhizal fungi, which are symbionts and essential to growth of certain crops, can be killed by fumigation. The subsequent crop may not do well until these organisms are restored.

Soil preparation is extremely important for successful use of any of the registered preplant nematicides. For a nematode-infested location that is to be planted with vines following a previous orchard or vineyard, a year-long procedure is suggested to prepare the area for fumigation. Beginning in summer or fall, remove trees or vines along with as many residual roots as possible, destroy plant residues, deep cultivate, and break up cultivation pans and soil layering. Next, during winter and spring, plant deep-rooted grasses (e.g. sudangrass) to help dry the soil and harvest the grass in summer. If you will be planting in a field following an annual crop, a shorter procedure can be used to prepare the area for fumigation. Plant the annual crop in spring, use it to dry the soil, and harvest it in summer.

Following harvest of the grass or annual crop, level the land (if necessary), cultivate, and do other operations required for planting. Finally, in late summer or fall, rip the soil to at least a 24 inch depth. If the subsurface soil is dry, surface clods are a problem, and you are in an area where light rains (less than 1 inch) occur in summer and fall, you may wish to wait to fumigate until after a light rain that would help to break up surface clods.

Prior to fumigation, the soil temperature should be checked at a one foot depth and the soil moisture at one foot intervals to a five foot depth. This is important because the amount of fumigant that should be used is based on the soil texture and temperature and the percent soil moisture. In general, the finer the soil texture, the more fumigant is necessary. A coarse textured soil (high percentage of sand) has large pore spaces in which the fumigant can disperse more readily than in a fine textured soil which has small pores and dries more slowly. If soil temperatures are too low, the fumigant will not volatilize and move through pore spaces. If temperatures are too high, the fumigant will volatilize and dissipate too quickly. If soil moisture is too low, the fumigant will not move properly and may adsorb to soil particles. If it is too high, the water in the soil pore spaces hinders movement. The Phytonematology Study Guide (UC ANR Publication 4045) contains a chart indicating the amounts of fumigants needed for various soil types and the ranges of temperatures and soil moistures over which they can be successfully fumigated.

Fumigation should be completed prior to November 15 because of the increasing possibilities of heavy rainfall and low soil temperatures. If surface clods are not a problem, fumigate in September or October when soils are dry. Observe the waiting period on the fumigant label before planting.

Most nematicide failures result from the chemical not reaching the nematode in sufficient concentration. For preplant applications, this is usually due to improper land preparation or applications outside of acceptable ranges of soil temperature and moisture.

Postplant Nematicides

Two recently registered nematicides are available for postplant use in vineyards in California. These are Enzone which is a liquid that releases carbon disulfide gas in the soil.

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DiTera is a toxin produced by a fungus in fermentaion similar to the way *Bacillus thuringiensis* (Bt) insecticides are produced. It is an OMRI approved product. The registration of fenamiphos (Nemacur from Mobay Inc.) is in the process of being phased out. Enzone needs to be applied in irrigation water. Applications of DiTera and fenamiphos should be to prewetted soil and be followed immediately by irrigation sufficient to move it several feet deep. Each of the available products has a different mode of action. Rotating between products can minimize the development of bacteria in the soil that decompose the active ingredients and can lead to an eventual loss of control.

Conclusion

Growers should consider using a combination of the management techniques discussed. The best results can be expected when vines are not suffering from other biotic or abiotic problems in addition to nematodes. Local Farm Advisors can be a valuable resource on how to best integrate nematode management into a total vineyard management program.

Becky B. Westerdahl is a UC Cooperative Extension Specialist, Department of Nematology, UC Davis.

Grape Varieties

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new grape stock from abroad make it critical for growers and researchers to be able to locate existing plant material already in the United States.

Each of the 650 varieties listed in the registry is profiled, with information provided about its pedigree, origin and use. Registry visitors are also provided with reference material that they can consult for further information, as well as listings of commercial grapevine nurseries and public grapevine collections.

The first phase of the registry is now complete. In addition to the lists of varieties and contact information for nurseries and public collections, the site has a database that allows users to enter any number of synonyms for grape names and search for the name most commonly used in the United States.

"The synonym search feature is the one that first-time users are the most excited about," said Ed Stover, curator of the National Clonal Germplasm Repository and author of the proposal that initiated the project. "Many important grape varieties from the Old World have as many as 20 or 30 different synonyms. With the creation of the National Grape Registry Web site, we have a new, simple tool for checking synonyms from many different countries and in many different languages. This is an extraordinary solution to a problem that has vexed grape growers and winemakers for years."

The first phase of the registry is now completed. During the second phase, information will be added about individual grape clones and the level of disease-test standards required for each clone.

Funding for the registry project was provided to UC Davis' Foundation Plant Services and the U.S. Department of Agriculture's National Clonal Germplasm Repository in Davis through a two-year grant from the Viticulture Consortium West and the American Vineyard Foundation. The online registry will be supported by the University of California Agriculture and Natural Resources, Foundation Plant Services, and the National Clonal Germplasm Repository of the USDA Agricultural Research Service.

Announcing

39TH CALIFORNIA NEMATOLOGY WORKSHOP

Tuesday, March 27, 2007 – 8:00 a.m. to 4:30 p.m.
Kearney Agricultural Center
9240 S. Riverbend Ave. ● Parlier, CA 93648
Phone (559) 646-6500 ● Fax (559) 646-6593

Goal: This workshop will provide practical information on replacement of Nemacur and methyl bromide.

7:30 **Registration**
8:00 **Welcome**
8:10 **Ole Becker –** Use of Abamectin seed treatments plus other biological agents.
8:40 **Lance Beem –** Bionematicides – what's real, what to avoid, what's in the future.
9:10 **Paul Giboney –** Post-plant performance of various nematicides in vineyards.
9:30 **John Chitambar –** Potato cyst nematode in Idaho and the impact on California.
10:00 **Poster Session and coffee break**
10:30 **Roger Duncan –** Performance of several new stone fruit and almond rootstocks.
11:00 **Jennifer Hashim –** Field performance of new and older grape rootstocks.
11:30 **Becky Westerdahl –** Several exciting nematicides and synopsis of earlier reports.

12:00 **Lunch –** Uncle Harry's Classic Meals (served to the first 100 attendees who RSVP).

1:00 **Tour –** Nine field trials that demonstrate alternatives to Nemacur or methyl bromide:

1. Use Roundup to rejuvenate existing vineyards or one year prior to replanting vines.
2. Evaluation of Krymsk 1, a potential new dwarfing rootstock for plum.
3. Evaluation of Viking, a new rootstock for stone fruits and almond.
4. Three grape rootstocks with broad nematode resistance.
5. Two grape rootstocks that may not need fumigation.
6. Tolerance of *Prunus* rootstocks to nematode feeding.
7. Tolerance of *Prunus* rootstocks to the rejection component of the Replant Problem.
8. VX211, a new walnut rootstock planted into various nematode infestation levels.
9. Second-leaf peach following treatments with various alternatives to methyl bromide.

There is no registration fee to attend.

However, you must be one of the first 100 to register in order to receive a lunch.

Complete form below, **Print and Mail** to Lois Strole, UC Kearney Ag Center, 9240 S. Riverbend Avenue, Parlier, CA 93648; or **Print and Fax** the form to her at **(559) 646-6593**.

2007 California Nematology Workshop – Kearney Ag Center, Parlier .... **Tuesday, March 27, 2007**

Name (Last, First, Middle Initial)   Company

Mailing address   Email address

City   State   Zip Code   Daytime phone (include area code)

I want an Uncle Harry's lunch if I am one of the first 100 to register: ◯ Yes ◯ No

PCA and Applicator Continuing Education Credit – pending ● Seating limited to the first 140 registrants

Calendar of Events

Local Meetings and Events:

San Joaquin Valley Table Grape Seminar
February 28, 2007
8:00 a.m.—12:00 p.m.
Visalia Convention Center
303 East Acequia
Visalia, CA
Contact: Juli Heidinger (559) 447-8350

39th California Nematology Workshop
March 27, 2007
8:00 a.m.— 4:30 p.m.
Kearney Agricultural Center
9240 S. Riverbend Avenue
Parlier, CA 93648
(559) 646-6500—*See page 8 for more information.*

U.C. Davis University Extension Meetings

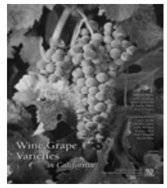
(800) 752-0881

Introduction to Wine Analysis for Professional Winemakers and Winery Lab Workers
March 10, 2007
8:00 a.m.— 6:00 p.m.
Enology Building, California Avenue
Davis, CA
Instructor: Michael Ramsey
Section: 063VIT201

Descriptive Analysis of White and Red Table Wines
March 24-25, 2007
9:00 a.m.— 4:00 p.m.
Da Vinci Building, 1632 Da Vinci Ct.
Davis, CA
Instructor:John Buechsenstein
Section: 063VIT205

Fundamentals of GIS for Vineyard Management
March 26, 2007
8:00 a.m. — 5:00 p.m.
Plant and Environmental Sciences, California Ave.
Davis, CA.
Instructor: Joshua Viers
Section: 063VIT203

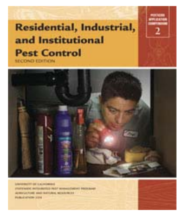
Publications from the University of California



Wine Grape Varieties in California, 2003
ANR Publication 3419
Price - $30.00 + tax and shipping

A comprehensive variety publication. Covers all the grape growing districts in California, highlighting 36 major varieties.

Revised Edition



Residential, Industrial, and Institutional Pest Control, 2nd Edition, 2006
ANR Publication 3334
Price - $30.00 + tax and shipping

Volume 2 in the Pesticide Application Compendium focuses on managing structural, food, and fabric pests, rodents, birds, and weeds.

Order Form

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Vine Lines

Produced by U. C. Cooperative Extension Farm Advisor Stephen J. Vasquez. Contact me for further article information, or to be added to the mailing list.

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