



What Can Landscape Managers Do to Help Honey Bees?

Most people have heard about the decline in honey bees during the last several years. Are there things that landscape professionals or home gardeners can do to help?

Better Nutrition, Fewer Pesticides

The actual cause of the honey bee decline is still uncertain. What is known is that a number of factors are probably involved. For instance, honey bees are in their most robust condition and able to best contend with stresses when they are well fed. In addition to water, honey bees require nectar sources for carbohydrates and a varied mix of pollens to provide proteins, lipids, vitamins, minerals, sterols, antioxidants, and other nutrients.

Drought, flooding, and conversion of former foraging grounds into large agricultural monocultures, highways, airports, developments, and so forth have led to honey bee malnutrition in many locations. Also, in the last 20 years beekeepers have been encounter-

ing a series of previously exotic pests that invade the hive and kill bees, such as the varroa mite; new honey bee diseases, including *Nosema ceranae*; and many RNA viruses.

Pesticides can also be involved in bee decline, especially when applied to plants when they are in bloom and bees are foraging. Many insecticides are highly toxic to bees including virtually all organophosphates, carbamates, and pyrethroid materials.

If not killed in the field, pollen-foraging bees can collect residue-contaminated pollens and bring them back to the hive

... continued on Page 6



K. Garvey, UC

Bee heading toward crown of jewels.



K. Garvey, UC

Honey bee on lavender carrying red pollen.



K. Garvey, UC

Support honey bees by designing landscapes with flowers that provide bees with nectar and pollen.

WHAT'S INSIDE ...

MSDS, Label Changes | Page 2

New Snail, Slug A.I. | Page 3

Oils as Pesticides | Page 4

Ask the Expert! | Page 5

Revised Resources | Page 6

SIGN UP ... for a free subscription to the *Green Bulletin* at <http://www.ipm.ucdavis.edu/greenbulletin/>

Pesticide MSDS Format Changes

It's been a long process, but the U.S. Occupational Safety and Health Administration (OSHA) is set to participate in the Globally Harmonized System of Classification and Labeling of Chemicals (GHS). According to the U.S. Department of Labor, the GHS "will provide a common and coherent approach to classifying chemicals and communicating hazard information on labels and safety data sheets. Once implemented, the revised standard will improve the quality and consistency of hazard information in the workplace, making it safer for workers by providing easily understandable information on appropriate handling and safe use of hazardous chemicals."







What it means to you is there will be some changes in the way chemical hazards are documented and presented in employee training. Eventually there may also be some changes to pesticide product labels. The best source of information regarding these changes is at <http://www.osha.gov/dsg/hazcom>, where a list of frequently asked questions can be found, along with responses from the department.

SDS to Replace MSDS

The first things to know are that Material Safety Data Sheets (MSDS) for chemicals will now be called Safety Data Sheets (SDS) and that all employees working with chemicals, such as pesticides, must be trained on new SDS elements by **Dec. 1 of this year**. Other necessary phases for the full adoption of GHS will occur in June 2015, and all employers must be fully compliant with GHS training by June 2016. The information in the SDS won't be much different from the current MSDS documents, but the information will be presented in a specific order to provide standardization. SDS documents will make use of standard pictograms to convey hazards (Figure 1).

Pesticide Product Labels Won't Change for Now

It's important to emphasize the U.S. EPA hasn't yet moved to amend its pesticide labeling regulations under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) to reflect the GHS. There are differences between EPA's current pesticide labeling requirements and the GHS related to classification criteria, hazard statements, pictograms, and signal words. For example, the GHS uses only two signal

<p>Health Hazard</p>  <ul style="list-style-type: none"> ■ Carcinogen ■ Mutagenicity ■ Reproductive Toxicity ■ Respiratory Sensitizer ■ Target Organ Toxicity ■ Aspiration Toxicity 	<p>Flame</p>  <ul style="list-style-type: none"> ■ Flammables ■ Pyrophorics ■ Self-heating ■ Emits Flammable Gas ■ Self-reactive ■ Organic Peroxides 	<p>Exclamation Mark</p>  <ul style="list-style-type: none"> ■ Irritant (skin and eye) ■ Skin Sensitizer ■ Acute Toxicity ■ Narcotic Effects ■ Respiratory Tract Irritant ■ Hazardous to Ozone Layer (Nonmandatory)
<p>Gas Cylinder</p>  <ul style="list-style-type: none"> ■ Gases Under Pressure 	<p>Corrosion</p>  <ul style="list-style-type: none"> ■ Skin Corrosion/Burns ■ Eye Damage ■ Corrosive to Metals 	<p>Exploding Bomb</p>  <ul style="list-style-type: none"> ■ Explosives ■ Self-reactives ■ Organic Peroxides
<p>Flame Over Circle</p>  <ul style="list-style-type: none"> ■ Oxidizers 	<p>Environment (Non-mandatory)</p>  <ul style="list-style-type: none"> ■ Aquatic Toxicity 	<p>Skull and Crossbones</p>  <ul style="list-style-type: none"> ■ Acute Toxicity (Fatal or Toxic)

OSHA

Figure 1. Pictograms and hazards.

words, *danger* and *warning*, while current pesticide labels may also bear the signal word *caution* for less severe hazards. As a result, SDSs that comply with OSHA's revised Hazard Communication Standard (HCS)/GHS requirements could be viewed as inconsistent with the FIFRA labeling, as some of the label elements might differ for the same hazards.

EPA believes explaining why the FIFRA label and the SDS contain different hazard communication elements will prevent users from being misled by the inconsistencies. To ensure this, EPA is asking registrants to include in their SDS the FIFRA label information and a brief explanation for any differences between it and the GHS hazard ratings in Section 15 of the SDS (Regulatory Information). You'll want to review this section during your trainings.

As you hear more about these changes and see new SDS documents, you'll want to start training your employees to meet the Dec. 1 deadline. To assist, OSHA provides some guidance at <http://www.osha.gov/Publications/OSHA3642.pdf>. At the end of the document is a link to English and Spanish QuickCards you can use in your training. For pesticides, refer to EPA's PR Notice 2012-1 at http://www.epa.gov/PR_Notices, which provides guidance to help manufacturers understand how to comply with both GHS and FIFRA. For the time being, users of pesticide products will need to be familiar with both the FIFRA and SDS (GHS) labeling systems until the FIFRA and OSHA labeling systems are harmonized.

—Cheryl Wilen, UC Statewide IPM Program, South Coast, cawilen@ucanr.edu

New Active Ingredient Available for Snails, Slugs

For the last 30 years, the primary mollusk (snail and slug) baits used in the landscaping industry have been those containing metaldehyde as the active ingredient. About 10 years ago, iron phosphate came on the market and is now also widely used, particularly in areas where people and pets may encounter the molluscicide. Recently a new active ingredient, ferric sodium EDTA, has become available for both home use and professional pest management.

You can find this active ingredient in new formulations of Corry's Slug & Snail Killer as well as Dr. T's Slug & Snail Killer, Slugexx, Iron Fist Slug & Snail Bait, Amdro Snail Block Slug & Snail Killer, and Ferroxx. Ferroxx is marketed to the professional, while all of the others are available to both home and professional users. Depending on the brand, these products contain 2 to 6% active ingredient (Table 1).

Although all these active ingredients are effective against snails (Figure 1) and slugs (Figure 2), there are important differences. Metaldehyde works very quickly, and you will see foaming and dead snails by the morning if applied at night. However, metaldehyde can poison and even kill dogs and other mammals that might feed on it.

Iron phosphate is much safer but also much slower acting. Snails may stop feeding on plants after consuming iron phosphate baits but can take up to seven days to die. On the plus side, iron phosphate may be more effective than metaldehyde during periods of high humidity or if there are rainy conditions.

The newest active ingredient, ferric sodium EDTA, works in a similar manner to iron phosphate but is somewhat faster—three days instead of seven. EDTA is used to make the iron (ferric) more available and therefore kill the mollusks faster. Still, be aware that

these new products, as well as the others, ought to be used in a way so that pets and children won't be tempted to eat the pellets.

Also note that recommended application rates for ferric sodium EDTA may be considerably lower than iron phosphate (Table 2). Formulated iron phosphate and ferric sodium EDTA molluscicides look very similar, so it is important to check the label to be certain the product is applied at the appropriate rates. To be most effective, products containing the active ingredients metaldehyde, ferric sodium EDTA, or iron phosphate should be broadcast or spread, not piled, near areas where the mollusks are causing damage (Figure 3).

Applicators and maintenance workers should also be reminded to remove plant debris and other snail and slug hiding places and to avoid overwatering, which increases mollusk activity.

For more information about snail and slug management, see *Pest Notes: Snails and Slugs* at <http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7427.html>. Briefer versions of this information, called Quick Tips, are also available on the UC IPM Web site both in English, <http://www.ipm.ucdavis.edu/QT/snailsslugscard.html>, and Spanish, <http://www.ipm.ucdavis.edu/QT/snailsslugscardsp.html>.

—Cheryl Wilen, UC Statewide IPM Program, South Coast, cawilen@ucanr.edu



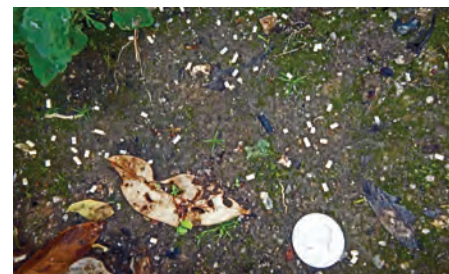
J. K. Clark, UC

Figure 1. Brown garden snail.



J. K. Clark, UC

Figure 2. Tawny slug on strawberry.



C. A. Wilen, UC

Figure 3. Don't pile snail baits but scatter, as these white iron phosphate pellets above.

Table 1. Registered Molluscicides Containing Ferric Sodium EDTA.

Product	% of A.I.
Amdro Snail Block Slug & Snail Killer	5
Corry's Slug & Snail Killer*	5
Dr. T's Slug & Snail Killer	6
Eliminator Snail & Slug Killer	2
Ferroxx	5
Ironfist Slug And Snail Bait	1
Slugexx	2

*Corry's is changing over its products to ferric sodium EDTA, but you may find packages with the same or similar name containing metaldehyde until stock is depleted.

Table 2. Comparison of Rates and Active Ingredients for Some Snail and Slug Products.

Product example	Active ingredient and %	oz/1,000 ft ²	Remarks
Deadline T & O	metaldehyde, 4%	3.6-7.2	Apply to ground only, not plant parts. Moisten ground before applying. Don't apply on ditch banks or other areas where it may enter bodies of water.
Ferroxx	ferric sodium EDTA, 5%	1.8-7.0	
Sluggo	iron phosphate, 1%	8-16	

*Read the label and apply as directed. These rates are for the products in the example.

Oils: Important Landscape Pesticides

Oils are some of the most useful pesticides available for managing pests on woody ornamentals and fruit trees. They are also widely used on many herbaceous flowers and vegetables. Oils control a range of soft-bodied insects and mites as well as several foliar diseases including powdery mildew (Table 1). Not only do oils leave no toxic residues, they are safe to use around people, pets, and wildlife; have low impact on beneficial insects; and won't harm honey bees unless applied directly to flowers during the time of day that bees are foraging.

Oils used for managing pests on plants are often called horticultural oils. Horticultural oils are derived from petroleum sources and are sometimes called mineral oil, narrow range oil, or superior oil. Other oils may be made from plants, such as canola oil, neem oil, or cottonseed oil. A number of other plant extract oils have also recently become available on the market.

How They Work

Regardless of their source, the primary way oils kill insects and mites is the same—by suffocation. Insects breathe through structures called spiracles. Oils block spiracles, reducing the availability of oxygen and interfering with various metabolic processes. When applied to insect or mite eggs, oils can penetrate the shells and kill the developing embryo. Oils may also act as a repellent in some cases, especially with some of the plant-based oils, and some such as neem oil have anti-feeding properties.

Because oils kill by smothering insects, apply the product so it completely covers the target pests. Careful attention must be paid to treat both the underside and topside of leaves, buds, and shoots and all locations where the insects or mites may be located. Spraying during the dormant season, when leaves are off trees or shrubs, is recommended for scales and some other insects, because it is easier to get good coverage on leafless trees (Figure 1). Because oils leave no toxic residues, they won't generally kill insects that move onto plants after treatment.

Table 1. Plant Pests Oil Sprays Control.

Dormant-season applications
aphid eggs
caterpillar eggs on bark (leafrollers, tent caterpillars, and tussock moth)
overwintering mites or mite eggs
scale insects (nymphs)
Spring and summer—foliar applications
adelgids
aphids (Figure 3)
black spot on rose
eriophyid mites
lacebugs
leafhoppers
mealybugs
powdery mildew
psyllids
sawflies feeding on foliage
scale insects (nymphs)
spider mites (Figure 4)
thrips
whiteflies

Usually, immature stages of insects are most susceptible especially with scale insects, mealybugs, and true bugs. Insects that feed within curled leaves such as leaf-curling aphids, leaf miners, or gall-forming species are protected from oil sprays and not well controlled. Oils don't control caterpillars, beetles, grasshoppers, and boring insects, with the exception of some caterpillars in the egg stage.

In some cases, oils improve the efficacy of other insecticides. For instance, applications of both codling moth granulosin virus (Cyd-X) and spinosad are more effective against codling moth when 1% oil is added to the spray.

For managing certain foliar diseases such as powdery mildew, oils can act as both a preventive and a curative fungicide, smothering fungal growth and inhibiting spore production (Figure 2). In many cases, the efficacy of oils in reducing powdery mildew is superior to



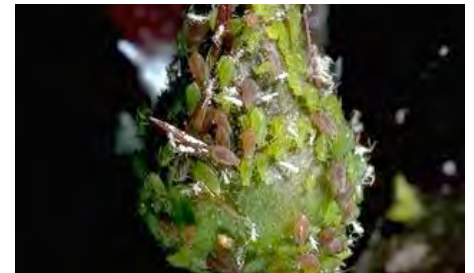
J. K. Clark, UC

Figure 1. Sycamore scale, which caused the spotting on these leaves, is most effectively controlled with a 1% oil application during the delayed-dormant season (bud break) when scales are at their most susceptible stage.



J. K. Clark, UC

Figure 2. The powdery growth on this rose leaf indicates an early-stage infection of powdery mildew—the best time to spray with oils.



J. K. Clark, UC

Figure 3. Aphids, such as the rose aphid pictured here, are well controlled with all types of horticultural oils.



J. K. Clark, UC

Figure 4. Oil sprays can reduce populations of spider mites.

standard synthetic fungicides, especially in reducing existing infections.

... continued on Page 5

Oils as Pesticides

... continued from the Page 5

Tips to Know

All oils now sold as pesticides are highly refined and can be used safely on most plants throughout most of the year, unless plants are drought-stressed. Exceptions include Japanese and red maples, walnuts, and smoke tree. Redbud, juniper, cedar, spruce, and Douglas-fir are also sometimes injured. Injury usually involves discoloration of leaves or needles. Walnut is very sensitive to oil sprays applied during bud break, and applications aren't recommended during the dormant season because of potential damage to buds and shoots.

Many plants are sensitive to oil damage when water-stressed, so be sure plants have been adequately irrigated before application. Most oil labels also warn against applying oils when temperatures are below freezing or above 90°F. Oils shouldn't be applied in combination with sulfur, or within 30 days of a sulfur application, because of potential phytotoxicity. As with any pesticide, always check product labels for precautions or other restrictions before applying.

—Mary Louise Flint, UC Statewide IPM Program and Entomology, UC Davis, mlflint@ucdavis.edu

Ask the Expert!

Q I like the idea of encouraging honey bees, but some of my clients are afraid of getting stung. Should they be?

A Honey bees rarely sting unless caught within clothing or stepped on with bare feet or when people interfere with bees gathering nectar and pollen or protecting their hive. Few people with bee gardens report being stung; however, it is best to locate plants that are highly attractive to bees away from doorways, busy pathways, or areas through which people frequently pass.

While stings are unpleasant, for most people they cause only temporary pain and swelling. About one to two people out of 1,000 are highly allergic or hypersensitive to bee stings and might die if not treated immediately. These people should carry medications to counter their reaction to a sting and take special precautions to avoid stings. If your client or a member of their family is allergic to honey bee stings, you may want to limit bee-attractive flowers in their landscape. See *Pest Notes: Bee and Wasp Stings* at <http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7449.html> for more information.

Q How do insecticidal soaps compare to horticultural oils?

A Insecticidal soaps are contact pesticides that, like oils, kill a similar spectrum of soft-bodied arthropods—aphids, scale nymphs, whiteflies, and mites. As is the case with oils, they must be applied to cover the pest's body to be effective. Soaps are believed to erode the arthropod's protective cuticle and damage cell membranes within the body leading to desiccation. Like oils, they leave no toxic residues and have low risks for human health, beneficial organisms, and wildlife. Unlike oils, they aren't effective as dormant treatments.

Soaps used as insecticides list potassium salts of fatty acids as the active ingredient. Not all soaps are effective, so use products labeled as insecticides to assure efficacy.

Revised Resources Now Online

UC IPM recently released five revised titles in its Pest Notes series of publications about home, garden, landscape, and wildlife pests.

Bed bugs have undergone a resurgence in pest status and can now be found even in the finest hotel and living accommodations. For the latest in detection and monitoring techniques, see *Bed Bugs* at <http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7454.html>.

Pantry Pests, <http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7452.html>, and *Clothes Moths*, <http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7435.html>, contain comprehensive identification and management information for these common household pests, while *Pitch Canker*, <http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn74107.html>, and *Horsehair Worms*, <http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7471.html>, round out the list.

To access almost 160 other titles, visit UC IPM's Pest Notes Web page, <http://www.ipm.ucdavis.edu/PDF/PESTNOTES/index.html>.



Landscapers Helping Honey Bees

... continued from the Page 1

for immediate consumption or long-term storage. There are serious concerns over the chronic, sublethal effects of these residues on the physiology of immature and adult bees.

A newer class of insecticides, the nicotinoids, which include imidacloprid, clothianidin, and dinotefuran, also pose hazards for honey bees. These products are systemic materials that move through the plant and will be included in nectar and pollen of flowers when they bloom. Although the neonicotinoid residues may not kill bees immediately, they may have sublethal effects, such as the suppression of immune and detoxification systems, that cause bees to be more sensitive to other stresses.

Use Plants and Pesticides Wisely

There are several ways landscape managers can help protect bees. When designing or replanting a landscape, consider honey bees and other pollinators in your plan. Include plants honey bees prefer, and try to ensure that several

bee-friendly plants will be blooming throughout the year.

For lists of California native plants that bees visit, see <http://beebiology.ucdavis.edu/HONEYBEES/floralvisits.html> or the UC Urban Bee Gardens page at <http://www.cnr.berkeley.edu/urbanbeegardens>. Also, if bees are still visiting certain flowers, delay removing spent flowers until bee visits taper off, even if the results aren't as aesthetically pleasing.

Also, avoid applying highly toxic insecticides, especially when plants are in bloom. Be aware that neonicotinoids tend to be stable compounds that can remain in the soil and in plants for months and still be present when the plants bloom.

Even when plants aren't in bloom, use nonchemical management methods or pesticides with little or low toxicity to bees whenever possible, as pesticides may leave toxic residues or there may be flowering weeds or other blooms nearby.



K. Garvey, UC

Bee collecting pollen on zinnia.

For information about relative toxicity of pesticides to bees, consult *How to Reduce Bee Poisoning from Pesticides* at <http://www.ipm.ucdavis.edu/PDF/PMG/pnw591.pdf>. Toxicity of many landscape and garden pesticides to bees is also listed in the UC IPM landscape and garden pesticide active ingredient database at <http://www.ipm.ucdavis.edu/PMG/menu.pesticides.php>.

—Eric Mussen, Entomology,
UC Davis, ecmussen@ucdavis.edu

Visit UC IPM's Web Site for Free Online Training

The UC IPM Web site offers several free online training courses for landscape and structural pest management professionals. Most courses offer continuing education units that satisfy the California Department of Pesticide Regulation (DPR), the Structural Pest Control Board or both. Topics include IPM, pesticides and water quality, herbicides, pesticide equipment, and calibration. Another course is designed to prepare you to take the DPR Maintenance Gardener Category Q Qualified Applicator Certification (QAC) exam.

Find these resources at <http://www.ipm.ucdavis.edu/training>.



**University of California
Statewide IPM Program**
One Shields Avenue
Davis, CA 95616-8621
Phone: (530) 752-8350
E-mail: ucipm@ucdavis.edu
Online: www.ipm.ucdavis.edu/greenbulletin



Produced by the University of California Statewide IPM Program with partial funding from the USDA NIFA EIPM Coordination Program. To simplify information, trade names of products have been used. No endorsement of named products is intended, nor is criticism implied of similar products not mentioned.

The University of California prohibits discrimination or harassment of any person in any of its programs or activities. The complete nondiscrimination policy statement can be found at <http://ucanr.org/sites/anstaff/files/107734.doc>. Inquiries regarding the university's equal employment opportunity policies may be directed to Linda Marie Manton, Affirmative Action Contact, University of California, Davis, Agriculture and Natural Resources, One Shields Avenue, Davis, CA 95616, (530) 752-0495.

WHAT IS IPM? Integrated Pest Management (IPM) programs focus on long-term prevention of pests or their damage through a combination of techniques including resistant plant varieties, biological control, physical or mechanical control, and modification of gardening and home maintenance practices to reduce conditions favorable for pests. Pesticides are part of IPM programs but are used only when needed. Products are selected and applied in a manner that minimizes risks to human health, beneficial and nontarget organisms, and the environment.