The Pesticide Label

Cooperative Extension Service
College of Tropical Agriculture and Human Resources
University of Hawai'i at Mānoa

Key to Pesticide Safety and Education

July–December 2008

Table of Contents

REGULATORY UPDATES

Special Local Needs (SLN)

New Product

For growers of **pineapple**—use of the pesticide **BSP Lime-Sulfur Solution** (Ag Formulators, Inc.; EPA Reg. No. 66196-2)—requires having a copy of **HI-080003**, valid 12/9/2008–12/8/2013—some notes: •Direct spray at peduncle. • Not more than one application per fruit. • Not for foliar applications. • Packers must wear long-sleeved shirts and long pants with chemical-resistant gloves during packing.

Renewed

For managers of **forests, offshore islands, and other areas** to protect native and endangered Hawaiian plants and animals—use of the pesticide **Ramik Mini Bars All-Weather Rat & Mouse Killer** (HAACO; EPA Reg. No. 61282-26)—requires having a copy of **HI-980005**, valid 6/9/2008–6/8/2013—some notes: For use by or in cooperation with government conservation agencies only. • Use only in tamper resistant bait stations. • Obtain approval prior to use. • Sign-posting, reporting, and disposal required as specified.

For managers of **tropical nut and fruit orchards and corn or soybean fields**—use of the pesticide **Rozol Mini Blocks** (Liphatech; EPA Reg. No. 7173-243)—some notes: requires having a copy of **HI-080001**, valid 7/31/2008–7/30/2013—some notes: Use tamper-resistant bait stations only. • Dispose of dead animals. • Do not apply within 15 feet of surface water.

DEVELOPMENT OF THIS NEWSLETTER WAS SUPPORTED IN PART BY THE STATE OF HAWAII DEPARTMENT OF AGRICULTURE

SLNs Expired or Expiring Soon

For managers of **irrigation systems (drip/trickle, sprinkler) for agricultural crops**—use of the product **Accu Tab® SI Calcium Hypochlorite Tablets** (PPG Industries, Inc.; 748 295)—permitted by the labeling **HI-030008**—is not allowed on or after the expiration date 6/18/2008.

For growers of **pineapple**—use of the product **Hyvar® X Herbicide** (E.I. du Pont de Nemours & Co.; 352 287)—permitted by the labeling **HI-030007**—is not allowed on or after the expiration date 6/25/2008.

For post-harvest application on **pineapple fruit**—use of the product **AG Sanitizer 12.5%** (Pioneer Americas, Inc.; 61667 4)—permitted by the labeling **HI-030006**—is not allowed on or after the expiration date 4/24/2008.

For growers of **pineapple**—use of the product **Livingston's Nature Ripe** (Livingston Group; 47893 3)—permitted by the labeling **HI-030005**—is not allowed on or after the expiration date 5/28/2008.

For growers of **pineapple grown for production of planting material** (i.e., suckers or seed pieces)—use of the product B**ayleton® 50% Dry Flowable Fungicide** (Bayer; 3125 320)—permitted by the labeling **HI-03000**4—is not allowed on or after the expiration date 4/7/2008.

For growers of **pineapple plants (non food)**—use of the product **Maintain CF125** (Repar; 69361 6)—permitted by the labeling **HI-980007**—is not allowed on or after the expiration date 9/30/2008.

For growers of **macadamia nut orchards**—use of the product **Ramik Mini Bars All Weather Rat & Mouse Killer** (HAACO; 61282 26)—permitted by the labeling **HI-980006**—is not allowed on or after the expiration date 7/30/2008.

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RECERTIFICATION CREDITS may be earned by certified applicators that score at least 70% on the set of comprehension evaluation questions about the "recertification" articles in this newsletter. These articles have a title which ends with "(Recertification)". However, credits may not necessarily be applicable for the following categories: Private 2, Private 3, Commercial 7f, and Commercial 11. The question sets (quizzes) are written and administered by the Hawaii Department of Agriculture (HDOA) staff. Ask about earning recertification credits at one of these HDOA offices: Kauai 274-3069, Oahu 973-9424/9409, Maui 873-3960, Hawaii 974-4143. The area code for all offices is 808.

GASEOUS PESTICIDE FORMULATIONS (recertification)

Seldom do the pesticides you apply contain pure pest-killing chemicals. These chemicals are often hard to mix, store, transport, or are unstable. Therefore, these *active ingredients* are usually combined with carriers or other *inert ingredients* that have no pesticidal properties. This combination of active and inert ingredients is called a pesticide *formulation*. It is the pesticide product in the container.

Most pesticide formulations are familiar to us as wettable powders, granules, pellets, and various liquids. But what about those floating miasmas known as aerosols, vapors, gases, fumes, fogs, and smoke? These mixtures of pesticide and air result from application of the formulation. As you can see from our list below, their definitions are sometimes unclear or overlapping. This article discusses changes in the states of matter that produce these mixtures of air and pesticide and the importance of vapor drift. The following article (page 5) is intended for fumigators and lists fumigants licensed for sale in Hawaii, common uses, and breathing apparatus requirements.

Definitions

Active ingredient: chemical(s) in a pesticide product responsible for pesticidal activity.

Aerosol: 1) a suspension of fine, solid particles or liquid droplets in a gas; 2) a pesticide formulation used to produce such a suspension; 3) a fog, fumes, or smoke.

Condensation: change in the state of matter from a gas to liquid.

Deposition: formation of a solid from its gas state; the reverse of sublimation.

Evaporation: 1) the process by which molecules in a liquid state (e.g., water) spontaneously become a gas (e.g., water vapor); 2) passing off in vapor or in minute particles.

Fog: fine particles of water suspended in the lower atmosphere; a low cloud

Fumigant: a pesticide in the form of a gas used to suffocate or poison pests in a confined area.

Gas (*vapor*): a state of matter made up of randomly moving molecules, atoms, etc., with no definite shape or volume.

Inert ingredient: material in a pesticide product with no pesticidal activity.

Miasma: term for a heavy vaporous atmosphere formerly thought to cause disease.

Smoke: 1) a suspension of solid particles in a gas; 2) small particles of carbon in a gaseous suspension from burning organic material

Sublimation: a specific type of vaporization from the solid to gas phase of matter with no intermediate liquid phase (e.g., dry ice)

Vapor (*gas*): the gas phase of another state of matter (liquid, solid).

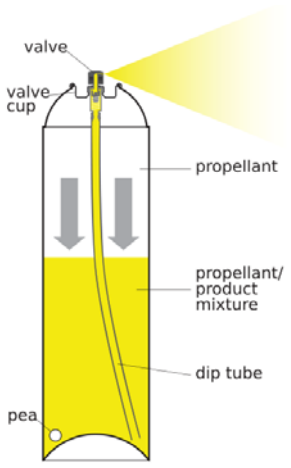
Vapor pressure: the pressure of a vapor (gas) in equilibrium with its non-vapor phases (solid, liquid) at a given temperature; substances with higher *vapor pressures* will vaporize (become vapor, gas) more readily than substances with a lower vapor pressure and are said to be *volatile*.

Volatility: a measure of how readily a substance vaporizes.

Volatilization: process by which a solid or liquid is vaporized; the conversion to a gas may be due to heating, reduced pressure, a chemical reaction, or a combination of these processes.

Pesticides and States of Matter

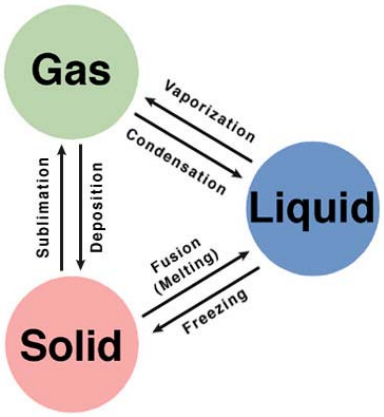
Aerosols are a common pesticide formulation in which small amounts of active ingredient are mixed with a propellant or solvent. The ready-to-use types are commonly available in pressurized, sealed containers. Homeowners buy this type to control mosquitoes, ants, wasps, fleas, etc. Some may be applied a little at a time (see figure). Others are total-release products—commonly called "bug bombs" or "room foggers"—that can be triggered only once, just before pets and people must leave the room. Another type of aerosol formulation is a liquid (not in pressurized containers) made to be applied with aerosol generators or foggers that break down the liquid into a very fine mist or fog (aerosol). This type is used for treating large indoor or outdoor areas.



Gas, or *vapor*, is a basic state of matter (see figure on page 4). Liquids can *evaporate* (*volatilize*) into a gaseous phase and gases can condense into a liquid state. Common solids melt, becoming a liquid, then evaporate into a gas. Some solids, though, can also

sublimate directly into a gas. Two pesticides examples are: 1) chloropicrin, a liquid fumigant or warning agent that evaporates into a gas; and 2) moth balls (naphthalene or paradichlorobenzene), a solid that sublimates to form a vapor.

The change of matter from solid to liquid to gas requires energy in the form of heat. At atmospheric pressure, it takes 80 calories of heat to melt 1 gram of ice, 100 calories to raise the liquid to the boiling point, and another 540 calories to vaporize that liquid. That's a total of 720 calories of heat absorbed by the ice and water from its surroundings. (The same amount of heat is needed for ice to sublimate.) During proper fumigation with sulfuryl fluoride, the heat required to vaporize the liquid fumigant is absorbed mainly from the air surrounding the end of the introduction hose. If the liquid is released too slowly, however, vaporization can occur around the valve and along the hose, thus causing freezing problems.



Fumitoxin® and Phostoxin® are examples of solid *fumigant* pesticide products that react with moisture in the air to form toxic hydrogen phosphide (phosphine) gas. They are available as pellets, tablets, and bags of finely ground aluminum phosphide and are commonly used in sealed structures, bins, vaults, barges, silos—even in tightly tarped piles—for control of some insects, mites, and rodents. Liquid water coming into contact with these products will also trigger release of phosphine, so precautions in storage, transport, and handling are especially important.

Pesticide Drift

Recent issues of this newsletter contained articles on the mechanics of pesticide drift (May 2007, p. 5) and reducing spray drift with windbreaks and buffer zones (April–June 2008, p. 5). These related to spraying tank mixes (liquids). The following comments refer to gases and solid particles.

Vapor drift is the movement of pesticides in the gas (vapor) state from the target area. Pesticides in the gas state tend to drift farther than pesticides in the form of liquid spray droplets. Drift can occur during application or when treated areas—soil, structure, container, silo, etc.—are improperly sealed, releasing the gas into the air where it can be blown offsite. If the chemical is highly volatile, the pesticide's labeling may list conditions during which it may not be applied, such as temperatures higher than 85°F, wind speeds greater than 5 mph, or low humidity.

Particle drift is the movement of *solid (dry)* particles from the target area during or shortly after application, according to the National Pesticide Applicator Certification Core Manual. This includes particles of the pesticide itself (e.g., dust or powder formulations) and soil particles to which the pesticide is attached.

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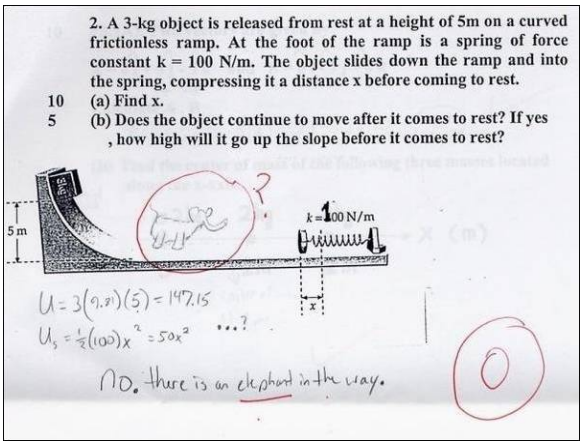
Just for Fun!



Answer to a test question by a creative student.

FUMIGANTS (recertification)

In this article we discuss fumigant pesticides licensed for distribution and use in Hawaii, including their active ingredients, general uses, and respirator requirements. These pesticides differ considerably, so it is not possible to present specific fumigation instructions in this short article. Therefore, the article and its summary table are not to be used in place of labeling requirements. If the instructions on the pesticide label are not adequate for your needs, consult the supplier or manufacturer for further information.

Fumigant and Aerosol

A *fumigant* is a gas (vapor) used to suffocate or poison pests in a confined area. This is different from a spray mist, a fog, or a cloud of dust or smoke. These are examples of an *aerosol*, a mass of air in which many tiny liquid droplets or solid particles are suspended. Aerosols affect the pest while in suspension or after settling on a surface, but cannot pass through porous materials or move into small holes, cracks, or crevices. Molecules of gas, however, can do this because they are much smaller than the droplets and particles in an aerosol. Gas can diffuse into pores within soil, wood, cardboard, certain types of plastic sheeting, surface cracks, joints, and seams, and small spaces in stacks, piles, and packages. (Droplets and particles, in some circumstances, also give off a small amount of gas that affects pests. This has been called the "fumigation effect" but it will not be discussed in this article.)

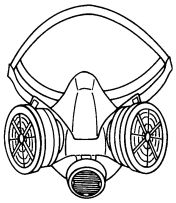
Formulations

Fumigant pesticides are formulated as either solids or liquids. All of the solids and most of the liquids are ready-to-use products. The other liquids must be diluted with water to activate them.

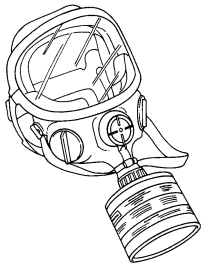
Types of fumigation can be divided in several ways. California, for example, divides fumigation into enclosed spaces and fields. Enclosed spaces include buildings, vaults, silos, chambers, vehicles, greenhouses, material covered by a tarpaulin, etc. Fields refers mainly to on-farm soil fumigation. Another way of grouping fumigation practices is whether or not a tarpaulin is used. Types of tarped fumigation would include structures (buildings), stacks and piles, soils, tarped commodities, etc. Non-tarped fumigation would include vaults, chambers, silos, containers, vehicles, etc. that may need additional sealing but not covering with a tarpaulin.

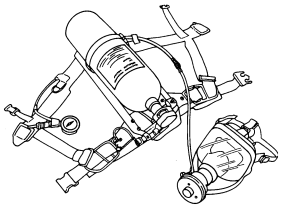
Respirators for Fumigation

Before considering individual fumigants, here is a short description of the basic types of respirators. For more information see "The Pesticide Label" January-May 2003 (p. 5). *Dust or particulate masks* can remove about 95% of the particles from the air, but are not effective against gases (e.g. fumigants). *Air-purifying respirators* filter contaminants from the surrounding air using special filter cartridges or canisters. They offer protection against particulate matter and specific gases at concentrations less than 2% and are useful when the oxygen content of the air is greater than 16%. Respirators that cover just the nose and mouth, called *half-masks*, may require additional eye protection whereas *full-face masks* do not. Breathing purified air through a filter or canister can be tiring, especially during long use. Therefore, *powered air-purifying respirators* are available that use an attached blower to move contaminated air through the canister, making breathing of the filtered air easier. At fumigant concentrations greater than 2%, or atmospheric oxygen less than 16%, an air-supplying respirator is usually


Half-mask respirator


Full-face mask


Full-face mask + canister



SCBA

required. The *self-contained breathing apparatus (SCBA)* has a tank with compressed air and is worn by the user. An *air-line respirator* has air supplied to it through a hose from an air pump in a nearby, clean-air location.

Respirators

1. Air purifying
   - Dust/particulate
   - Half-mask (cartridge)
   - Full-mask (cartridge)
   - Full-mask (canister)
   - Powered air-purifying
2. Air supplying
   - Self-contained apparatus
   - Air line respirator

Fumigants Currently Registered for Use in Hawaii

Chloropicrin

Chloropicrin is liquid at room temperature and normal atmospheric pressure; it is packaged in metal or glass containers. It is either pumped slowly into the fumigation site or poured into an open pan where it evaporates into its gaseous state. Chloropicrin is listed as effective against soilborne nematodes, wireworms and some serious disease-causing fungi. One formulation is used to inhibit fungal wood rot in poles and timber. Chloropicrin is often used in other colorless, odorless fumigants as a *warning agent*. It is mixed with 1,3-dichloropropene (see below) and methyl bromide (all products) and introduced separately into some structures before fumigation with sulfuryl fluoride (Vikane®). Also known as "tear gas", it immediately signals the presence of a fumigant leak.

1,3-dichloropropene

Products in this chemical class are applied to the soil as liquids, evaporating into a volatile gas lethal to soilborne fungi, nematodes, wireworms and centipedes. InLine and Telone C-15, C-17 and C-35 contain chloropicrin and respirator requirements are based on its concentration. Telone EC and Telone II do not contain chloropicrin and half- or full-face air-purifying respirators are acceptable for use at lower concentrations. At higher concentrations, such as large liquid spills, an air-supplied respirator is required.

Dazomet

The active ingredient *dazomet* is formulated as a dust and as granules. Basamid and Basamid G are labeled for control of various weeds, soilborne fungi and nematodes. The granular product volatilizes in the soil and the rising gas kills germinating weed seeds and seedlings, exposed nematodes (outside root) and root rot fungi. It can be used as a pre-plant soil disinfestant, in preparation to revitalizing turf, for disinfesting compost piles, potting media, etc. When used in enclosed areas, such as greenhouses, air-purifying cartridge or canister respirators are required. DuraFume and UltraFume are labeled for protection or treatment of wood products, such as poles, timber and laminated wood.

Phosphine

Aluminum and magnesium phosphide are formulated as tablets and pellets and in polyethylene cells, bags, and strips. When exposed to moisture in the air they produce phosphine gas. Fumitoxin and Phostoxin are labeled for control of the pre-adult stages of many insects. A full-face mask with phosphine canister must be worn at concentrations below 15 ppm (parts per million) and an air-supplied respirator above 15 ppm.

Methyl bromide

M*ethyl bromide* is a gas that has been compressed to form a liquid which is then stored under high pressure in a metal canister. When released through a valve at the fumigation site it rapidly forms a gas. Methyl bromide is one of the premier soil fumigants due to its broad effectiveness against soilborne diseases, nematodes, insects and weeds. Under the Montreal Protocol enacted in 1989, however, methyl bromide was considered a volatile organic compound (VOC) and as such was slated to be phased out in the U.S. by 2005. However, some specific agricultural uses still remain and there is some disagreement as to whether it qualifies as a VOC. Methyl bromide is applied, together with chloropicrin, by soil injection and followed by tarping for at least 48 hours. It is also labeled for use as a soil sterilant in greenhouses. If the air concentration of chloropicrin is above 0.1 ppm, or the methyl bromide reading is greater than 5 ppm, a supplied-air respirator must be worn.

Metam sodium

Vapam® and other metam sodium products are mainly used in agricultural soils for preplant eradication of insects, mites, nematodes, and select weeds and fungi. These fumigants are applied with water to well-cultivated, previously wetted soil either by sprinkler, drip, or flood irrigation. The depth of their effectiveness is equal to the depth of the products' infiltration at application. The volatilizing liquid chemical kills organisms as it moves up through the soil as a gas. Its effectiveness is enhanced when applied at temperatures below 90°F—at high temperatures the active ingredient volatilizes too quickly—and by covering the soil loosely with a tarpaulin. Field workers must use either half-face masks with face-sealing goggles, or full-face masks, fitted with either cartridges or canisters. PolFume and WoodFume control wood-rotting fungi in poles, timber and wood chips.

Sulfuryl fluoride

Sulfuryl fluoride is sold as a liquid under pressure and is mainly used for ridding structures of termites, cockroaches, bedbugs, moths, rodents and other household pests. The EPA considers it an effective alternative to methyl bromide, which is being phased out due to its effect on the ozone layer. It penetrates structures faster than methyl bromide, leaves less residue after aeration and, like methyl bromide, is effective against a wide range of structural pests. Its penetration ability allows for faster fumigation and it is easily contained by plastic fumigation tarps. The cost of fumigating structures with sulfuryl fluoride is reported to be comparable to methyl bromide. If the sulfuryl fluoride concentration in an area is less than 1.0 ppm, no respirator is required. If it is greater than 1.0 ppm, an air-supplied respirator must be used.

Selected References

Dow AgroSciences. 1998. Structural fumigation manual for use with Vikane gas fumigant. Dow AgroSciences.

U.S. Environmental Protection Agency. 2008. Structural fumigation using sulfuryl fluoride: DowElanco's Vikane gas fumigant.

Ozone Layer Depletion-Regulatory Programs. Viewed 16 Dec. 08 at http://www.epa.gov/ozone/science/ods/classone.html

Utah State University Extension Service. Study guide for fumigation. Viewed on 17 March 2008 at http://ag.utah.gov/plantind/sg_fumigation.pdf

Bond, E.J. 1984. Manual of fumigation for insect control. Viewed on 17 March at: http://www.fao.org/docrep/x5042e/x5042E00.htm#Contents

Fumigants available in Hawaii, pests eradicated, some labeled uses, and respirator requirements.

Product	Target Pest	Application Method, Site, Commodity	General Respirator Requirements**
1,3-dichloropropene			
InLine (liquid)	Fungi, nematodes	Soil fumigant	If chloropicrin level is >0.1 ppm = A-PR >4.0 ppm = A-SR
Telone C-15 (liquid)	Fungi, nematodes	Soil fumigant	F-FR
Telone C-17 (liquid)	Fungi, nematodes	Soil fumigant	If chloropicrin level is <0.1 ppm = H-FR >1.0 ppm = F-FR
Telone C-35 (liquid)	Fungi, nematodes	Soil fumigant	If chloropicrin level is <0.1 ppm = H-FR >1.0 ppm = F-FR
Telone EC (liquid)	Fungi, nematodes	Soil fumigant	Lo-conc. = goggles Liquid contact H-FR Hi-conc. = A-SR
Telone II (liquid)	Fungi, nematodes	Soil fumigant	Lo-conc. = goggles Liquid contact H-FR Hi-conc. = A-SR
Dazomet			
Basimid G (granular)	Weeds, fungi, oomycetes, nematodes	Tarped compost, soil piles; seeds; preplant seedbeds, turf regeneration, etc.	Enclosed areas, e.g. greenhouse: H-FR + goggles or F-FR, both with O-V CAR/CAN
Basamid (granular)	Same as Basimid G	Same as Basimid G	Same as Basimid G
DuraFume (liquid)	Wood rot fungi	Utility poles, pilings, timbers, laminated wood	No requirements (not for use in enclosed space)
UltraFume (pellets, tablets)	Same as DuraFume	Same as DuraFume	Same as DuraFume
Methyl bromide			
Terr-O-Gas (liquid/gas)	Weeds and seeds, insects, nematodes, fungi, oomycetes, protozoa	Greenhouse and soil fumigation (tarped)	If chloropicrin level is >0.1 ppm or methyl bromide is >5 ppm = A-SR (SCBA)
Meth-O-Gas (liquid/gas)	Insects, rodents, mites, spiders, snails, nematodes	Agricultural commodities, food products, forest/plant products, beehives	If methyl bromide is >5 ppm = A-SR
Meth-O-Gas Q (liquid/gas)	Moths, beetles, mites, snails, rodents, brown tree snakes, fungi, some bacteria	Structures, vaults, containers, bins, rail cars, vehicles, silos, restaurants	If methyl bromide is >5 ppm = A-SR
Pic-Brom 25 (liquid/gas)	Weeds, fungi, oomycetes, nematodes, wireworms	Greenhouse and soil fumigation (tarped)	If chloropicrin level is >0.1 ppm or methyl bromide is >5 ppm = A-SR (SCBA)
Tri-Con 57/43 (liquid/gas)	Weed and grass seeds, nematodes, wireworms, fungi, oomycetes	Greenhouse and soil fumigation (tarped)	If chloropicrin level is >0.1 ppm or methyl bromide is >5 ppm = A-SR (SCBA)
Metam sodium			
Metam Clr 42% (liquid)	Weeds, insects, mites, fungi, nematodes	Soil fumigant	F-FR, O-V CAR/CAN

PolFume (liquid)	Wood rot (fungus), insect damage	Wood poles and chips	No requirements
Sectagon 42 (liquid)	Nematodes, fungi, bacteria, weeds, seeds	Soil fumigant	H-FR + face-sealing goggles or F-FR + O-V CAR/CAN
Vapam HL (liquid)	Weeds, nematodes, fungi, oomycetes	Soil Fumigant	Same as Sectagon 42
Vapam (liquid)	Same as Vapam HL	Same as Vapam HL	Same as Sectagon 42
Woodfume (liquid)	Wood-rot fungi	Wood poles, timber	No requirements
Phosphides			
Fumi-Cel, Fumi-Strip (cells, strips)	Insects (pre-adult)	Vault	<15 ppm = F-FR + phosphine canister; >15 ppm or unknown conc. = A-SR
Fumitoxin Tablets, Pellets, Bags	Insects (pre-adult)	Vault	F-FR + canister or A-SR must be available; not needed if outside of treatment area
Phostoxin Prepac Rope, Tablets	Insects (pre-adult)	Vault	Same as Fumitoxin Tablets
Weevil-Cide Gas Bags, Tablets	Insects (pre-adult)	Vault	Same as Fumitoxin Tablets
Chloropicrin			
TimberFume (liquid)	Fungi	Timber, piled wood, poles and posts	>0.3 ppm = A-SR
Tri-Clor EC Fumigant (liquid)	Fungi, insects, nematodes, wireworms	Soil, structure (greenhouse)	>0.1 ppm = O-V CAR or O-V CAN; >4 ppm = A-SR
Tri-Clor Fumigant	Same as Tri-Clor EC	Same as Tri-Clor EC	Same as Tri-Clor EC
Chloropicrin Warning Agent (liquid)	Warning agent for non-detectable fumigants (e.g. methyl bromide)	Soil or structure with 1,3-dichloropropene, methyl bromide or sulfuryl fluoride	>0.1 ppm = A-SR
Sulfuryl fluoride			
Zythor (liquid/gas)	Insects (all stages) including drywood and Formosan termites, bedbugs, cockroaches	Structures, vehicles, containers, household and construction materials, etc.	<1.0 ppm = no respirator required >1.0 ppm = A-SR (SCBA recommended)
Master Fume (liq./gas)	Same as Zythor	Same as Zythor	Same as Zythor
Vikane (liq./gas)	Same as Zythor	Same as Zythor	Same as Zythor
Profume (liq./gas)	Same as Zythor	Same as Zythor	Same as Zythor

** Air-purifying respirators (A-PR): half-face respirator (H-FR), full-face respirator (F-FR), organic-vapor cartridge/canister (O-V CAR/CAN). Air-supplied respirators (A-SR) include the self-contained breathing apparatus (SCBA) and a respirator that is supplied through a hose with clean air from a generator. Check labels for specific requirements and updates.

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EPA'S NEW REGULATIONS FOR SOIL FUMIGANTS (recertification)

In July 2008 the U.S. Environmental Protection Agency (EPA) announced completion of new soil fumigant safety standards. These standards are intended to protect agricultural workers and others in or near fumigated fields. The changes are listed in the new Reregistration Eligibility Decisions (REDs) for each fumigant: chloropicrin, dazomet, metam sodium, metam potassium and methyl bromide. Iodomethane (methyl iodide) and 1,3-dichloropropene (Telone) are still under review. View the original EPA announcement at http://www.epa.gov/oppsrrd1/reregistration/soil_fumigants/#more and updates regarding buffer zones, at http://www.epa.gov/oppsrrd1/reregistration/soil_fumigants/

Soil fumigation is often necessary in intensive cropping systems, such as pineapple, strawberry, tomato and sweet pepper. However, vapor drift during and for several days after treatment can pose a health risk to workers and those in the surrounding area. One of the EPA's current responses to this problem was to classify all soil fumigants as restricted use pesticides (RUPs).

This article briefly summarizes other important changes in the RED fact sheets. These measures will appear on new pesticide labeling for all soil fumigants by 2010. Some measures are specific to certain fumigants and may or may not be included in the following summary.

Buffer zones must be established by fumigators around treated fields. The size of the zone will depend on the application rate, field size, application equipment and methods, and vapor-control measures used (e.g. tarping).

Posting around the buffer zone is necessary to prevent people from entering the area and being exposed to the fumigant. Posting may not be necessary if a physical barrier, such as a fence, is present or if all of the area 300 feet around the buffer zone is under the control of the owner or operator.

Agricultural worker protection considers the safety of *handlers*, those who operate fumigation equipment, assist in fumigant application, monitor air concentrations, and install, repair, perforate or remove tarps. Some labels currently require handlers

Soil injection of methyl bromide and chloropicrin followed by immediate tarping

to use respirators when fumigant levels reach a certain action level, but there is no requirement for monitoring these levels. New labels will require regular monitoring and if air concentrations are higher than can be mitigated with air-purifying respirators, handlers will be required to stop work and leave the area. During actions taken to lower air concentration of the fumigant, an air-supplied respirator may be required (see previous article). Handlers must also be 1) fit-tested for respirators, 2) trained on respirator use, and 3) certified physically fit to wear and use the respirator. Tarp perforation and removal requirements and reentry prohibitions are also defined in the REDs.

Applicator and handler training programs must be developed by the registrants (pesticide manufacturers) to ensure proper fumigant use and good agricultural practices.

Good agricultural practices are often listed on pesticide labels. Examples of these practices include: proper soil preparation prior to fumigation, ensuring optimal soil moisture and temperature, equipment calibration, etc. The EPA has now made these recommended practices mandatory.

Application methods, practices, and rate restrictions not backed by sufficient data will be prohi-

bited. For example, some applications where tarping was not previously required must now be tarped, and in some cases maximum application rates have been lowered to reflect effective use rates.

Restricted use pesticide classifications have been extended to include fumigants containing metam sodium, metam potassium, and dazomet. Chloropicrin, 1,3-dichloropropene and methyl bromide are already RUPs.

Site-specific fumigant management plans (FMPs) will be required from users, in writing, before fumigation begins. FMPs will allow the EPA to make site-specific decisions based on existing conditions. All FMPs must address 15 elements, including: general site information, applicator information, application procedures, how buffers were determined, posting, record keeping, etc. The certified applicator must verify in writing that the FMP is current and correct before starting the fumigation.

Emergency preparedness and response requirements are part of the EPAs risk mitigation effort. In spite of our best efforts, accidents, human error and unexpected weather changes still occur. To prepare for these instances, EPA is requiring first responder education and site-specific responses and management activities in case of accidental chemical releases. Registrants must provide for training of first responders in high fumigant use areas who can identify and respond to fumigant exposure incidents. Site-specific response requires on-site monitoring of buffer zones by the applicator and initiation of the emergency response plan if fumigant concentrations along the perimeter reach a level of concern.

Notice to state and tribal lead pesticide regulation agencies by applicators will be required before fumigation begins.

Community outreach and education programs, including the first responder program, must be developed by fumigant registrants. They must address the risk of bystander exposure by educating the community about fumigants, buffer zones, how to recognize early signs of fumigant exposure, and how to respond in case of an accident. These educational programs are scheduled for 2009, followed by introduction of revised fumigant labels in 2010. **The new safety measures mentioned in this article will not be in effect until the new labels appear.** Currently, gaps in existing fumigant data are being filled and new technologies are being developed to reduce fumigant emissions. The next full review of soil fumigants in 2013 will consider new data and the latest fumigants submitted for registration.

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RISING COSTS OF FUEL AND FARMING

Farming is a risky business and it is getting riskier. Though prices for many agricultural commodities are nearing record highs, input costs for fuel, fertilizer, pesticides and new technology are keeping pace. This trend became apparent in 2005 when the USDA reported farm costs for fuel and fertilizer alone had increased 61.5% since 2002. Prices farmers paid for all items were up 12.9% for the same period[1]. In Canada, the 2007 Farm Input Price Index (annual price farmers paid for a specific input) was up 7.5% over the year before. Animal feed prices (+28.7%) led the rise, followed by fertilizers (+22.7%)[8]. According to a U.S. agricultural economist, the cost of production is predicted to grow by more than 30% in 2008, with fertilizer costs climbing 82% for corn and 117% for soybeans[6]. This newsletter article examines reasons for the high cost of oil and petroleum-based products and the global effects on agriculture caused by these rising costs.

Reasons for the rising cost of oil

Everyone who drives a car or walks past a gas station knows the price of gas at the pump increased dramatically in 2008. Actually, the cost of crude oil started to rise about 10 years ago. In De-

cember 1998 a barrel of oil (bbl) on the New York Mercantile Exchange (NYMEX) was at a low of $10.72. In March 1999 the Organization of Oil Exporting Countries (OPEC) reduced production and by the end of the year the price was above $25 bbl. At the same time, the easily accessible oil in existing fields was disappearing, increasing extraction costs. Demand for oil in the U.S. throughout the 1990s continued to grow, increasing by 2% to 3% per year at the end of the decade. During the same period, the demand for oil in developing countries escalated in spite of rising prices[2].

World consumption of oil was 79 million barrels (MMbbl) per day in March 2003 when the "Iraq War" began, up 6 MMbbl a day from 1998. This led to a reduction in OPEC's oil surplus at a time when jet fuel demand was up 50% in the U.S. The need for energy was also growing in China, where potential shortages of electricity in their factories forced them to use back-up diesel generators. Global demand for oil in 2004 unexpectedly increased by 2.8 MMbbl per day to 82.3 MMbbl per day. Almost one-third of this was due to China's increasing energy requirements. This was also a time when the wealthy oil-producing countries of the Persian Gulf became oil-consuming countries[2].

Another contentious issue in the price of energy is the trading of oil on paper. Commodity traders, most with no intention of taking delivery of the purchased oil, can buy and sell it through NYMEX. This speculative practice is driving up the price of oil but opinions differ on its overall impact. Congress has been considering restrictions on oil speculation for several years,[3,4,7] though some believe the main influence on oil prices is supply and demand.

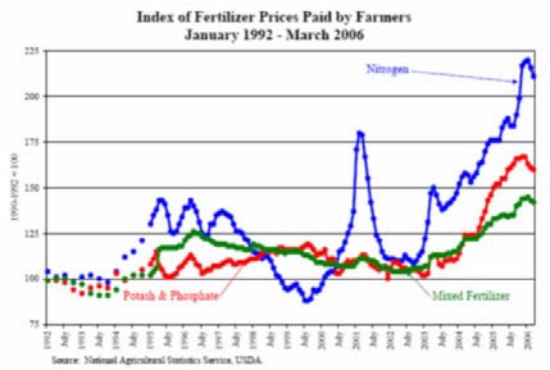
There are several bills before the U.S. Congress to restrict commodity price manipulations. Senator Daniel Inouye (D-HI) is cosponsor of Senate Bill S.2991, which would limit excessive speculation on crude oil futures[3]. Currently, S.3268, the Stop Excessive Energy Speculation Act of 2008, is before the U.S. Senate. According to Senator Inouye, this bill would: 1) keep speculators from trading commodity futures on foreign markets to avoid U.S. regulations; 2) require monitoring of large commodity transactions in order to detect and prevent price manipulation; and 3) routinely monitor index traders to ensure that their trading practices are not adversely affecting the price of energy commodities[3].

Energy Costs and Farm Prices

The high price of oil and natural gas affects the whole economy, including the cost of farm inputs. Dr. David Kohl, a retired agricultural economist from Virginia Tech University, says that eight out of every ten dollars spent in agriculture is linked to oil[5]. The obvious impact of higher gas prices is on transportation costs, both on and off the farm. Every input reaches the farm by ship, plane, train, roadway, or a combination of these. In addition, most farm purchases are either manufactured (tractors, irrigation supplies, tools, pesticides) or otherwise produced using oil-based energy (electricity, seeds, plants, fertilizers).

The price of fertilizer affects most commercial farmers. The cost of nitrogen fertilizer, for example, has increased with the price of natural gas which is responsible for about 80% of its production cost. Natural gas is formed in the same way as oil, by the decay of organic matter in the absence of oxygen. Natural gas, however, is formed deeper in the earth than oil (>6,000 m) and at greater temperatures and pressures. Both oil and natural gas are lighter than water and the surrounding rock and rise towards the surface where they are extracted by drilling. Phosphorus and potassium are mined and mining costs are also tied to the price of energy[6]. From January 2007 to January 2008, the price of diammonium phosphate (nitrogen and phosphorus) rose from $252

to $752 per ton, prilled urea (nitrogen) went from $272 to $415 per ton, and muriate of potash (potassium) rose from $172 per $352 per ton during the same period. Other important factors affecting the



cost of fertilizer include the increased demand for plants and plant products to produce biofuel, a growing call for grain-fed meat, and an escalating use of natural gas[5].

The price of oil affects pesticide prices in ways other than manufacturing and transportation costs. Most pesticides are produced synthetically using a hydrocarbon base (hydrogen atoms and carbon atoms). Other elements are then added to create a use-specific pesticide. The major source of hydrocarbons for pesticides is crude oil.

In October 2008, the price of crude oil fell from near $150 bbl to about $65 bbl. This may have been a correction to a price more closely reflecting supply and demand. Whatever the reason, the still-high price of oil will continue to affect agricultural production costs, forcing marginal farming operations out of business and reducing the security of others. The traditional blueprint for a successful farm was based on an existing market, favorable weather conditions and acceptable pest levels. Now, however, good business planning and field management plus the adaptability to volatile market changes may typify the successful farms of the future[5].

Note: Since this article was written in early October 2008, defaults in the U.S. sub-prime housing market and other economic disturbances have triggered a global financial crisis. In the meantime, the price of crude oil has been as low as $45 bbl.

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You can't go home again.

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Pesticide Shelf Life (recertification)

Pesticides in general are manufactured, formulated, and packaged to specific standards. However, when stored improperly, they can break down, especially under conditions of high temperature and humidity.

Dry formulations such as wettable powders (WP), soluble powders (SP), water-dispersible granules (WDG), and granular (G) can become caked and compacted. Emulsifiable concentrates (EC) can lose their ability to form emulsions. Some pesticides can actually become more toxic, flammable, or explosive as they break down.

Pesticide formulations that contain low concentrations of active ingredients generally lose effectiveness faster than more concentrated forms. Sometimes a liquid pesticide develops a gas as it deteriorates, making opening and handling containers quite hazardous. Certain pesticides have a characteristic odor. A strong odor in the storage area may indicate a leak, a spill, or an improperly sealed container.

It may also be a clue that the pesticide is deteriorating, because the smell of some chemicals intensifies as they break down. If none of these problems is found, chemical odors can be reduced with exhaust fans or by lowering the temperature of the storage area. Pesticide containers, including fiber and metal drums, pails, cans, bottles, bags, boxes, overpacks, and liners, have an important effect on storage and shelf life. If stored for long periods, these containers may eventually corrode, crack, break, tear, or fail to seal properly. The label may become illegible as well.

If a pesticide container needs to be replaced, transfer the pesticide to another container of the same type, such as a polyethylene jug, a thick paper bag, or a brown glass bottle. With plastic jugs, try to find a jug made of the same type of plastic. You can at least get a jug from the same group of plastics by checking the recycling number on the bottom of the jug and using a replacement jug with the same number. Obtain a replacement label from your pesticide dealer to put on the new container.

If stored in a cool, dry area that is out of direct sunlight, pesticides will generally have an extended shelf life. Protection from temperature extremes is important because heat or cold can shorten a pesticide's shelf life. At temperatures below freezing, some liquid formulations separate into their various components and lose their effectiveness. High temperatures cause many pesticides to volatize or break down more rapidly. Extreme heat may also cause glass bottles to break or explode.

One way to ensure that you avoid problems with shelf life or storage is to only buy what is needed for one season. Buying more pesticide than is necessary because of reduced case lot prices or a sale may become more expensive in the long run, when it comes to disposing of excess pesticide.

Before storing chemicals, read the label and follow any specific guidelines listed. Store different groups of pesticides, such as herbicides, insecticides, and fungicides, in separate locations in the storage area. This will help prevent cross-contamination from fumes and vapors as well as accidental use of the wrong type of pesticide. Never store chemicals near any type of animal feed. Always store chemicals out of the reach of children, preferably in a locked cabinet or room in which only pesticides are stored. Store personal protective equipment, such as gloves, goggles, aprons, and respirators, in another clean, dry location away from pesticide fumes.

Note: This article by Martha Smith and Phil Nixon is from the Illinois Pesticide Review and is presented without editing. It is available at http://web.extension.uiuc.edu/ipr/i5098_829.html

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NEWS BOARD

Editor's Note:

Greetings,
This is the last issue we will send through the mail. New issues will be available on our webpage http://pestworld.stjohn.hawaii.edu/pat/Newsletter_main.html. So few subscribers showed interest in continuing their subscription, that I decided to save the extra costs of printing and mailing. These resources will be used for our study guides and Pesticide Risk Reduction short courses. We wish you a meaningful holiday season and a brighter 2009.
Aloha

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New Fumigation Guide Available

This notice is for people who will be taking the Hawaii Department of Agriculture's certification examination for any of these categories:

- Private 2—agricultural pest control with fumigants
- Commercial—7a fumigation pest control (for licensed pest control operators)
- Commercial—7e vault fumigation pest control
- Commercial 9—regulatory pest control.

In the study packets for these categories, *Fumigation Study Guide for Hawaii (Nov. 2008)* replaces the older booklet titled *Fumigation*. The new 36-page booklet is now available for downloading or purchase. It is just one item in the study packets. The other items remain unchanged.

To download the new booklet free of charge, click on the title in the list posted at http://pestworld.stjohn.hawaii.edu/studypackets/spcatgor.html

To purchase a printed version of the entire study packet for any of the categories listed above, mark your order on the Agricultural Diagnostic Service Center's order form and send it in with your payment. Download the form from http://pestworld.stjohn.hawaii.edu/studypackets/spcatgor.html or contact the ADSC for a copy: telephone (808) 956-6706 or fax (808) 956-2592. (The ADSC is located at the Manoa campus of the University of Hawaii.)

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New Pet Incident Reporting for Veterinarians

The National Pesticide Information Center (NPIC) has developed a Web site for veterinarians to report pesticide incidents involving animals. It can be accessed through the American Veterinary Medical Association (AVMA) at http://www.avma.org/ under the Animal Health Section. Click on "Adverse Event Reporting," then use the members-only link under the pesticide reporting heading.

The site was developed by NPIC with input from the Pesticide Program of the Environmental Protection Agency (EPA), the AVMA's Clinical Practitioners Advisory Committee, and the Council on Biologic and Therapeutic Agents. The site was designed to obtain relevant information by means of a user-friendly form for busy practitioners.

The data will be evaluated by EPA. Most of the reports of more severe pesticide-related incidents EPA receives are neurological or dermatologic in nature. The reports from veterinarians will help improve the quality of all animal incident data.

NPIC is a cooperative effort between Oregon State University and EPA. NPIC provides objective, science-based information about a variety of pesticide-associated subjects to the general public, health care providers, physicians and veterinarians, as well as to local, state, and federal agencies.

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PREVIOUS RECERTIFICATION ARTICLES

April–June 2008—Reducing Spray Drift: Windbreaks and Buffer Zones (p. 5).

February–March 2008—Pesticide Labels (p. 4), Engineering Controls for Pesticide Exposure (p. 7).

October 2007–January 2008—What is a Pesticide (p. 3), Special Hazards of Restricted Use Pesticides (p. 5), Supervising Noncertified Applicators of Restricted Use Pesticides (p. 9).

June–September 2007—Agricultural Use and Non-Agricultural Use Labeling Statements (p.3), Employee Protection from Pesticides (p.6), Pesticides and Skin Problems (p.10).

May 2007—ASAE 572 Spray Droplet Classification (p.3), Mechanics of Drift (p.5).
January/April 2007—Records of Restricted Use Pesticide Applications in Hawaii (p.3), Sharing Application Information about Agricultural Use Pesticides (p.8).

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Online edition: http://pestworld.stjohn.hawaii.edu/pat/newsletter_main.htm