chem·i·cal

'kemək(ə)l/

noun

a compound or substance that has been purified or prepared, especially artificially.

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But according to chemists, *everything* is a chemical.

Chemicals could include….

- Water
- Fertilizers
- Pesticides
- Soil and soil amendments

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Pesticides include

- **Biocide**: kills microorganisms.
- **Fungicide**: kills fungi that may infect and cause diseases in plants, animals, and people.
- **Herbicide**: kills weeds and other plants that grow where they are not wanted.
- **Insecticide**: kills insects and other “bugs.”
- **Miticide**: also called acaricides, kills mites and ticks.
- **Molluscicide**: kills snails and slugs.
- **Nematicide**: kills nematodes
- **Ovicide**: kills eggs of insects and mites.
- **Rodenticide**: kills rodents, rats, mice

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About Pesticides

- Caution Should Always Be Used When Handling Pesticides
- Never Make Recommendations for Use of Pesticides Other than Those Listed on the Label
- Never Recommend the Use of Restricted Chemicals!

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If you use enough of it, any chemical can be harmful

(to the plant, to the environment, to people and pets)…

So use the least toxic option you can, only as much as you need, and only when you really need it.

This is the heart of IPM –

Integrated Pest Management

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IPM can be reduced to four elements:

- whether to treat.
- when to treat.
- how to treat.
- how well did treatment work?

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Consequences of Treatments

- Pesticide Residue.
- Pest Resistance to Pesticides.
- Pest Resurgence following pesticide use.
- Secondary Pest Outbreaks.
- Health hazards.
- Social factors
- Cost
- Appearance

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Pest Control Choices

- ***Cultural controls***
- ***Physical and mechanical controls***
- ***Biological Control Methods***
- ***Chemical & microbial controls, from least to more toxic***

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Chemical & Microbial Controls

- **BT (*Bacillus thuringiensis*)** - protein crystals that act as stomach poisons.
- **Pheromones** (confusants) - used to disrupt insect mating.
- **Pheromone attractants** - used to trap insects.
- **Insect growth regulators** - chemicals that disrupt insect metamorphosis process.
- **Botanical pesticides** - plant derived pesticides (e.g., Neem).
- **Insecticidal soaps** - soaps that break down insects' outer covering.
- **Chemical controls –**
- **Selective pesticide** - a pesticide that only effects a limited population of pests and is less likely to also damage beneficial insects.
- **Broad range pesticide** - A pesticide that kills everything - good or bad.

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Pesticides are toxic by design –

They are designed to kill living organisms that are considered “pests.”

They cannot tell the differences among pests and people and pets.

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Exposure occurs by various routes:

- Oral (dangers include drinking or eating or smoking while spraying)
- Dermal*
- Inhalation*
- Eyes

*usually most dangerous

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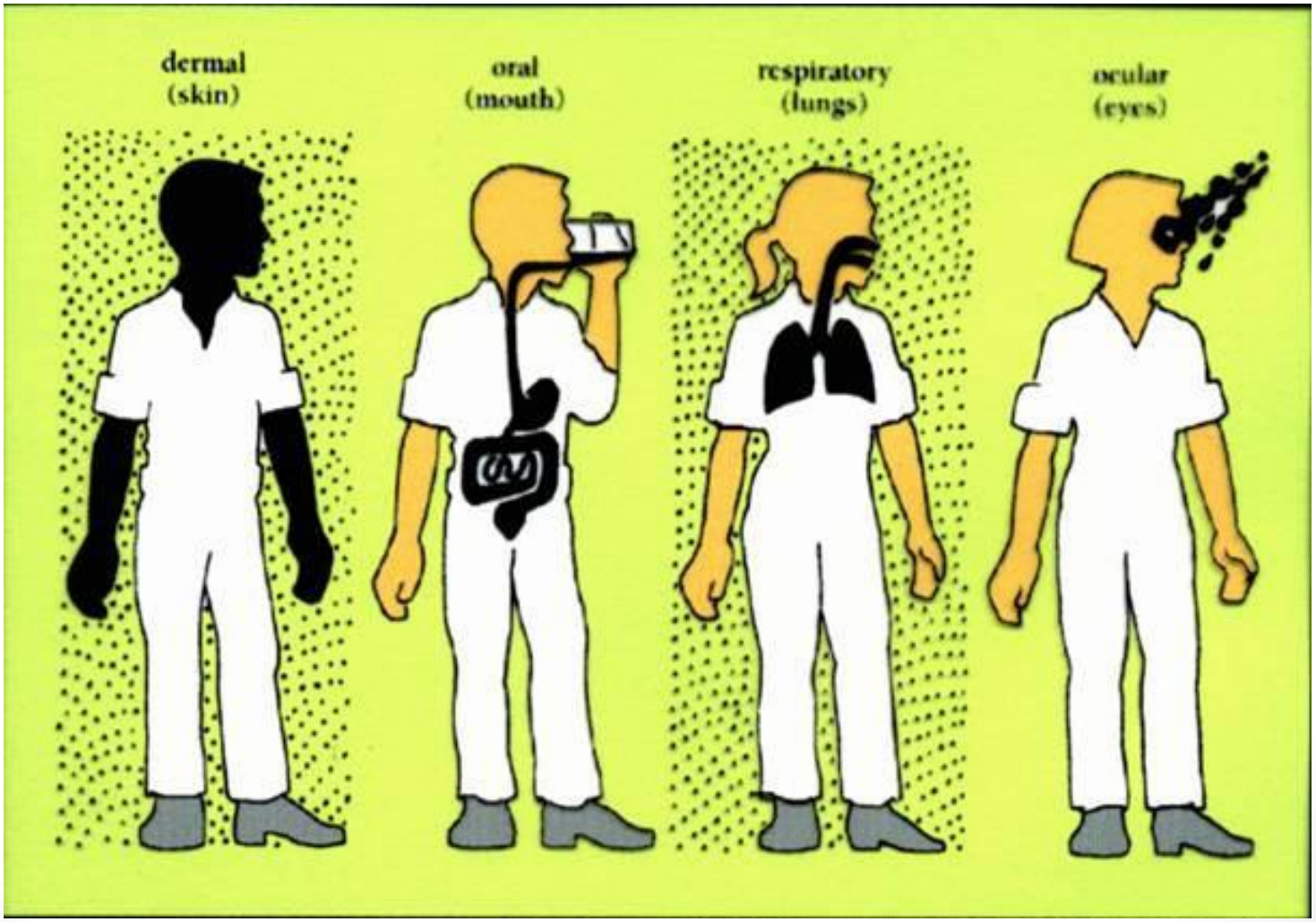

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Every pesticide will have a specific "mode of action"- how the pesticide works on the targeted pest.

- **Selective:** products kill only a few closely related organisms.
- **Broad spectrum (non-selective)**: kills a range of pests and also non-target organisms.
- **Contact**: kills when it touches the external surface of the target organism.
- **Systemic**: carried through the internal system of treated animals or tissues of treated plants.
- **Residual**: remains toxic to pests long after application.
- **Fumigant**: volatile enough to be inhaled by the pest in lethal doses.
- **Repellent**: distasteful to pests making them avoid treated areas.

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Some additional terms applicable to fungicides include:

- **Protectant:** applied before infection.
- **Eradicant**: applied after infections appear; kills on contact.
- **Multi-site, broad-spectrum surface protectants**: do not enter the leaf; the active ingredient remains on the leaf surface. (CONTACT)
- **Single-site, mostly locally systemic**: do enter the leaf; the active ingredient penetrates to the interior of the leaf (upon entering the leaf, the fungicide is carried out to the ends of the leaf, it is ***not*** translocated upward to subsequent new growth). (SYSTEMIC)

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Some common formulations are:

- **Solution (S):** liquids in a ready to use or concentrated form.
- **Emulsifiable concentrates (EC or E):** an active ingredient mixed with an oil base that is diluted with water before application; it must be continually agitated to keep it in solution.
- **Aerosols (A):** low concentration solutions applied as a fine spray.
- **Soluble powders (SP):** powders dissolved in water before application.
- **Wettable powders (WP or W):** an active ingredient combined with a fine powder that is mixed with water before application.
- **Baits (B):** an active ingredient mixed with an edible or attractive substance.
- **Granules (G):** an active ingredient mixed with coarse particles of inert material that are applied directly.
- **Dusts (D):** an active ingredient added to a fine inert clay or talc that is applied directly.

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For more information, see

- The pesticide label (a legal document)
- MSDS (material safety data sheet)
- Poison Control Center, 1-800-222-1222
- National Pesticide Information Center (NPIC) (800-858-7378), http://npic.orst.edu/
- PESTICIDE MODES OF ACTIVITY – THE IMPORTANCE OF ROTATION by Roger Bryan and Raymond Cloyd on the website of Tri-State Rose Society of Chattanooga, Tennessee, http://nyx.meccahosting.com/~a00084eb/

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How Toxic Is This Chemical?

The commonly used measure of oral and dermal toxicity is **LD_{50}** (the lethal dose to kill 50% of the study population). ***The lower the LD_{50} the more poisonous the chemical is.***

LD_{50} is usually expressed in milligrams (mg) of material per kilogram (kg) weight of target.

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I Danger Poison: highly toxic, taste to 1 teaspoonful.

I Danger: highly hazardous; pesticide specific (see label).

II Warning: moderately toxic or hazardous; a teaspoon to an ounce.

III Caution: low toxicity; more than an ounce, less than a pint.

IV Caution: low toxicity; over a pint.

A ***skull and crossbones*** on the label indicates a highly toxic pesticide.

DANGER without a skull and crossbones symbol shows the pesticide is a potent skin or eye irritant.

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First read the label

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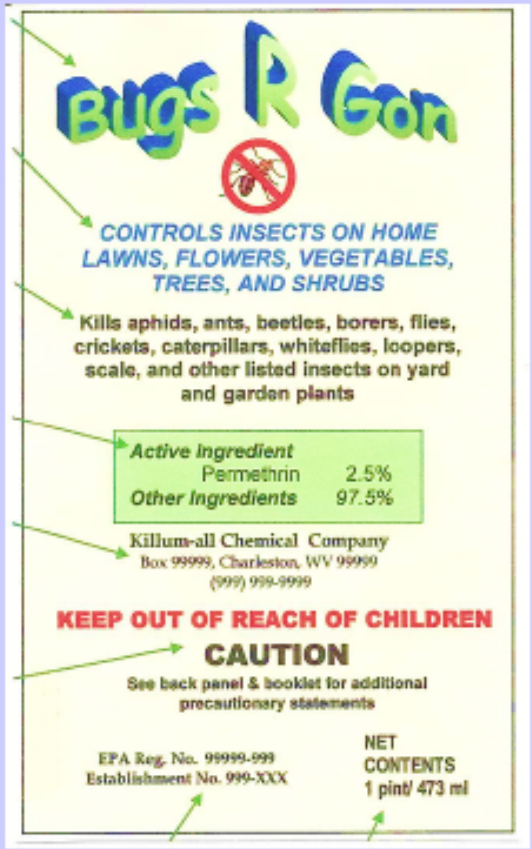
What Does a Pesticide Label tell You?



A-- Brand name
B – Where used & what for
C – Specific pest it controls
D – Ingredients toxic to pest
E – Manufacturer's info
F – <u>Signal Word</u>
Caution – least toxic
Warning – moderately toxic
Danger – highly toxic
G – EPA Registration Number
(Nice to have in an emergency)
H – Amount

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Using Pesticides Safely

- Identify the problem you wish to control and **use the proper chemicals**.
- **Select the least-toxic pesticide**; choose products with the signal word **Caution** if possible.
- Choose an effective product that is labeled for use against the pest you want to control.
- Select the best formulation for your conditions.
- **Buy only the amount of pesticide for the current season** and always store it in the original container in a dry, dark place.
- **Don’t use restricted pesticides** unless you have a Certified Pesticide Applicator's license. It's not only against the law, it is dangerous.
- Don’t use additives to spray materials unless recommended by the manufacturer; they may interact with the chemical and cause plant damage.
- Use a **spreader sticker** only according to label information to prevent plant damage; many liquid chemicals already contain a spreader sticker.
- **Don’t move or split a pesticide and store part of it in an unmarked container**. This is not legal, and it’s dangerous.

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Pesticide Resistance

Pesticide resistance is the ability of a life form to develop a tolerance to a pesticide. It develops when pesticides are used too often and when the same pesticide or similar pesticides are used over and over again.

Pests that become resistant to a pesticide will not be affected by the pesticide, and are more difficult to control.

- Use selective pesticides that break down quickly.
- Use pesticides that have different sites of action.
- Alternate different pesticide groups, if there is more than one generation of pest.

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MOA	CHEMICAL CLASS	TRADE NAME	TOXICITY			TYPE			TYPICAL APPLICATIONS
			C	W	D	S	T	C	
1	Organophosphates	Orthene		√			√		Control of aphids, leafrollers, jap beetles, midge and thrips on roses
		Acephate 75	√				√		Control of aphids, thrips and jap beetles on roses
		Malathion	√					√	Control of aphids, jap beetles, leafhoppers, scale, thrips on roses
		DuraGuard ME	√					√	Control of aphids and thrips on roses
		Cygon		√		√			Control of aphids, leafhoppers and thrips on roses
	Carbamates	Mesurol 75-W			√			√	Control of aphids and thrips on ornamental plants
		Sevin	√					√	Control of aphids, jap beetles, leafrollers, scale, etc. on roses
2	Pyrethroids	Talstar	√					√	Control of aphids, jap beetles, thrips, spider mites, etc. on roses
		Tempo*	√					√	Control of aphids, budworms, thrips, etc. on roses
		Mavrik	√					√	Control of aphids, thrips and spider mites on roses
		Scimitar	√					√	Control of aphids, budworms, jap beetles,thrips, etc. on roses
		Astro	√					√	Control of aphids, jap beetles, whiteflies, etc. on roses
	Chlorinated Hydrocarbons	Kelthane			√			√	Control of spider mites on roses
		Thiodan		√				√	Control of pests on field crops (eg., corn, tomatoes, etc.)
		Lindane	√					√	Seed and seedling protection of field crops (eg., wheat, barley, etc.)
3	Glycoside	Avid		√			√		Control of spider mite adults and leafminers on roses
	Carbazate	Floramite	√					√	Control of spider mites, at all life stages, on roses
	Phenoxypyrazole	Akari 5SC		√				√	Control of spider mites, at all life stages, on roses
4	Chloronicotinyls	Marathon	√			√			Control of jap beetles, and thrips on roses
		Merit*	√			√			Control of aphids, jap beetles, thrips, etc. on roses
	Spinosin	Conserve	√				√		Control of thrips and spider mites on roses
5	Growth Regulators/ Inhibitors	Azatin	√					√	Control of caterpillars, jap beetles and leafrollers on roses
		Hexygon	√					√	Control of spider mite eggs and larva on roses
		TetraSan	√				√		Control of spider mite eggs and larva on roses
6	Tetronic Acid Derivatives	Forbid 4F	√				√		Control of spider mites, at all life stages, on roses
	Soaps and Oils	Kontos	√			√			“Two-way” systemic for controlling insects and spider mites
		Safer’s Soap		√				√	Control of aphids, leafhoppers, spider mites and thrips on roses

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Personal Protection

Before using any pesticide, plan ahead, and wear the appropriate protective gear. That protection should be used ***from the time you begin handling the pesticide container until your final clean-up***.

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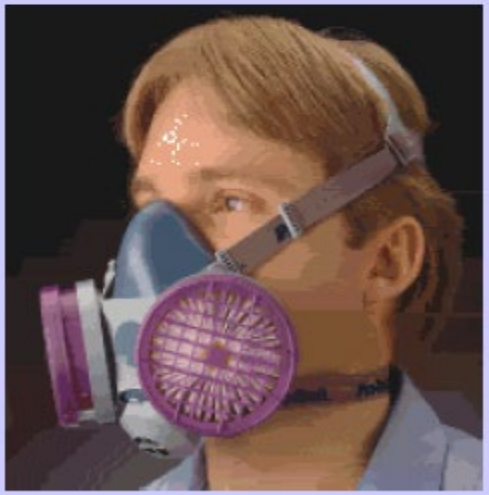

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When you spray –

- Make sure roses are well watered before spraying.
- Never spray in the strong sun or when temperatures are above 80°F. It's hard on plants, and hard on you.
- Don't apply pesticides just prior to rainfall or on a windy day. Early AM is usually best time to spray in Atlanta.

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- Cover up pet dishes, sandboxes, plastic pools, etc. before spraying.
- Bring children and pets indoors when applying pesticides.
- Warn neighbors that live close by before spraying so they will have the opportunity to close windows and bring in children and pets.
- Put on the proper gear before opening the pesticide container.
- Wear clean clothing that provides **full skin coverage** (long pants, a long-sleeved shirt, socks, closed shoes and gloves).
- Don't wear **leather** shoes, boots, or gloves while handling pesticides as they cannot be decontaminated easily. Don't wear sandals.
- Don't wear shoes made of canvas or other porous materials.
- **Cover the head** to prevent pesticide being absorbed through the scalp.
- Remove rings and watches because spray material may concentrate there.
- Wear **waterproof gloves** with long, tight-fitting wrists.
- **Use a respirator** when using air blast sprayers to protect from spray drift.

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Mixing

- Re-read the label before using a pesticide, **don't rely on your memory**.
- Open, mix and dilute the pesticide **outdoors** or in a well-ventilated area.
- **Use care when opening containers**; don’t use the same knife or scissors to open the bags that you use with food.
- Avoid creating dusts or splashes when opening a container or pouring liquids.
- **Use measuring cups and containers that are dedicated for pesticide use**; don’t use for other purposes.
- Mix the pesticide at the recommended rate and amounts; **don’t "guess" with the measurements.**
- **Mix only what you need** and can use in that spray session.
- Fill tank with water until about one-half full.
- Add concentrate gradually while water is swirling; don’t add water to concentrate.
- **Rinse measuring containers** three times, adding rinse water to the tank.
- Consider ready-to-use products to avoid the hassles / hazards of mixing.
- Use care when filling the sprayer to **avoid splashes**.

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Applying

- Apply at the recommended rate. Stronger is not better.
- **Don't eat, drink or smoke** while applying pesticides.
- **Avoid pesticides coming into contact with your eyes, mouth, skin or breathing spray mists**.
- Don't use your mouth to siphon liquids from containers or to blow out clogged lines, nozzles,
- **Minimize drift** by reducing the distance between the nozzle and the target area.
- **Spray the undersides and tops of the leaves.**

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Don’t spray your roses with the same equipment you used to spray herbicides.

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Clean-up

- Keep pets and children out of the area until the pesticide dries.
- Wash off any furniture, play equipment, etc., that may have been exposed to the spray.
- Wash gloves with soap and water before removing them.
- Wash hands and face immediately after spraying and before drinking, eating or smoking.
- Remove clothing worn during spraying and wash in a separate load before wearing them again (run an empty "rinse cycle" before washing other clothing).
- Wash eyeglasses and / or goggles.
- Shower after spraying.

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Pesticide Disposal

- **Never dispose of pesticides in storm drains or sewers, dry wells, sinks, or toilets**.
- **Clean pest control equipment** in a location where rinse water cannot flow into gutters, storm drains or sewers, or open waterways.
- **Rinse the pesticide container carefully three times and drain the rinse water back into the sprayer** or the container used to mix the pesticide. Use the rinse water as a pesticide, following label directions.
- If you can't finish using a pesticide, check with your local waste management authority for appropriate pesticide disposal procedure. You can also call 1-800-CLEANUP or go to www.cleanup.org to get this information.
- Empty, triple-rinsed pesticide containers can possibly be recycled but not reused; check with your local recycling program to confirm local ordinances.

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Be careful out there!