



# About Pesticides: Types, Names and Formulations

April 2017

## What are Pesticides?

Pesticides are necessary tools used for managing damaging and invasive pests in agriculture, forestry and the landscape. Pesticides include all materials that are used to prevent, destroy, repel, attract or reduce pest organisms. Insecticides, herbicides, fungicides and rodenticides are some of the more well-known pesticides. Others include growth regulators, plant defoliants, surface disinfectants and some swimming pool chemicals. Under federal legislation, all pesticides used in Canada must be registered by Health Canada. This includes all types of pesticides used in both conventional and organic production systems, whether they are manufactured or naturally occurring.

## Pesticide Names

Pesticides are named three ways: by active ingredient, by trade name, and by chemical name.

- **The active ingredient** is the chemical that controls the pest. The name of the active ingredient is also known as the common name and is written beside the guarantee on a pesticide label.
- **The trade name** is the brand name that the manufacturer gives to the pesticide. The trade name is the prominent name on the front of a pesticide label. Pesticides with different trade names can contain the same active ingredient, and some pesticides have more than one active ingredient.
- **The chemical name** is the name of the chemical structure of the active ingredient and is used by scientists.

### Example:

- **glyphosate** is the common name of a herbicide **active ingredient**
- **Roundup** is one of the many **trade names** for herbicide products containing glyphosate
- **N-(phosphonomethyl) glycine** is the **chemical name** of the active ingredient in Roundup

## Types of Pesticides

Pesticides can be grouped or classified in several different ways, including by the pests they control, their chemical structure, how/when they work, or their mode of action (site of action).

### Classification by Target Pest Species

Most pesticides may be classified according to the pests they kill. The word ending or suffix -cide means to kill. The following types of pesticides are used to kill specific kinds of pests:

<u>Pesticide</u>		<u>Pest Controlled</u>	<u>Pesticide</u>		<u>Pest Controlled</u>
algicide	-	algae	miticide	-	mites
avicide	-	birds	molluscicide	-	snails, slugs
bactericide	-	bacteria	nematicide	-	nematodes
fungicide	-	fungi	piscicide	-	fish
herbicide	-	weeds	rodenticide	-	rodents
insecticide	-	insects			

## Classification by Chemical Structure

Pesticides can be grouped according to chemical structure. Pesticides with similar structures have similar characteristics and usually have a similar mode of action.

## Grouped by Mode of Action (MOA)

Pesticides can be grouped according to their mode of action or the way a pesticide controls the target pest. This is also referred to the primary site of action. For example, one insecticide may affect an insect's nerves while another may affect moulting. One herbicide may mimic the plants growth regulators and another may affect the plants ability to convert light into food. The MOA of a pesticide is listed on the label as a group number or letter. Products with a similar MOA will have the same group number.

**Biopesticides** include microbial pesticides (containing a live bacterium, fungus, virus, protozoan, or alga as the active ingredient), and chemicals derived from animals, bacteria, fungi and plants. A common biopesticide is *Bacillus thuringiensis* (Bt), that has different strains to specifically control caterpillars, mosquitoes, or beetles.

## Grouped by How or When They Work

Pesticides can also be classified according to how or when they work.

- **Contact pesticides** generally control a pest as a result of direct contact. Insects are killed when sprayed directly or when they crawl across surfaces treated with a residual contact insecticide. Weed foliage is killed when enough surface area is covered with a contact herbicide.
- **Systemic pesticides** are pesticides which are absorbed by plants or animals and move to untreated tissues. Systemic or translocated herbicides move within the plant to untreated areas of leaves, stems or roots. Systemic insecticides or fungicides move throughout treated plants and kill certain insects or fungi. Some systemic insecticides are applied to animals and move through the animal to control pests such as warble grubs, lice, or fleas. Some pesticides only move in one direction within the plant, either up or down. Some pesticides are considered locally systemic. These will only move a short distance in a plant from the point of contact.
- **Foliar pesticides** are applied to plant leaves, stems and branches.
- **Soil-applied pesticides** are applied to the soil. Some are taken up by roots and translocated inside the plant. Other soil-applied herbicides kill weeds by affecting the germinating seedling. Most soil applied pesticides require tillage or water to move them into the soil.
- **Fumigants** are chemicals that are applied as toxic gas or as a solid or liquid which forms a toxic gas. The gas will penetrate cracks and crevices of structures or soil.
- **Preplant herbicides** are applied to the soil before seeding or transplanting.
- **Preemergent herbicides** are applied to the soil after planting but before emergence of the crop or weed.
- **Postemergent herbicides** are applied after the crop or weed has emerged.
- **Eradicant fungicides** control fungi that have already infected plants.
- **Protectant fungicides** prevent fungal infections. They retard fungal growth or prevent the organisms from entering treated plants.
- **Selective pesticides** will only control certain pests.
- **Non-selective (or broad-spectrum) pesticides** will control a wide range of pests.
- **Suffocating insecticides** clog the breathing system of insects and may affect eggs.
- **Residual pesticides** do not break down quickly and may control pests for a long time.
- **Non-residual pesticides** are quickly made inactive after application and do not affect future crops or pests.

## Types of Pesticide Formulations

When a pesticide active ingredient (a.i.) is manufactured, it is not in a usable form. It may not mix well with water or may be unstable. Therefore the active ingredient is mixed with other compounds to improve its effectiveness, safety, handling and storage. This mixture of active ingredient and inert (inactive) ingredients is called a pesticide formulation. Some formulations come ready to use while others must be mixed before use. One active ingredient is often made into several different formulations.

When choosing between formulations consider:

- If it registered for the use (pest/crop)
- Which will be most effective against the pest and current life stage
- What formulation works best in your application equipment
- Which will result in less drift or runoff
- Whether the proper safety equipment available
- Which is safest for workers, bystanders or nearby sensitive areas or organisms
- The cost

Pesticide formulations may be solids, liquids or gases. The most commonly used formulations are listed in the following table.

**Table of Common Pesticide Formulations**

Name and Abbreviation	Description	Advantages	Disadvantages	Typical Use
<b>Solids</b>				
Bait	Mixture of active ingredient (a.i.) and food that attracts pests. Made as meal, pellets, or liquid; Most are solids.	Easy to spot treat. Easy to apply by hand. Usually ready to use.	Children, pets, or wildlife could eat it.	Baits for: insects, rodents, birds, or slugs.
Dry flowable (DF) or Water Dispersible Granules (WDG)	Mixture of a.i. and inert material made into small pellets or granules. Forms a suspension in water.	Less dusty than WP which reduces inhalation hazard.	Spray mix requires constant agitation. Abrasive (increased wear on nozzles & pumps).	Sprays for insect, disease, and weed control.
Dust (D or DU)	Finely ground inert particles (i.e. talc, clay, volcanic ash)	Ready to use. No mixing.	Visible on plants. Easily inhaled. Easily drifts.	Spot treatment. Animal powder. Seed treatment.
Ear Tag / Vapour Strips	Solid material with volatile or solid a.i. Slowly releases vapour.	Ready to use.		Animal ear tags. Fly control
Granules (G or GR)	Dry inert materials (i.e. clay, walnut shell, corn cob) combined with a.i.	Ready to use. No mixing. Minimal drift.	Some dust produced. May be eaten by birds. May need incorporation.	Soil treatment for insect or weed control.
Pellets (P)	Inert material containing a.i. Like granules, but has more uniform shape and weight.	Easy to spot treat. No mixing. Ready to use. Minimal drift.	Some dust produced. Needs special application equipment.	Baits to control rodents, slugs
Soluble powder (SP)	Dry powder or granules which dissolve in water to make spray solution.	Agitation not needed after mixing.	Dust can be hazardous to applicator if inhaled.	Mostly sprays for insect & weed control. Few SP products available.
Wettable powder (WP or W)	Finely ground inert ingredients with a.i. Forms a suspension in water.	Less skin absorption than EC's.	Dusty. Needs pre-mixing and constant agitation. Abrasive, wears nozzles. May clog screens and filters.	Sprays for insect, disease, and weed control.

Name and Abbreviation	Description	Advantages	Disadvantages	Typical Use
<b>Liquids</b>				
Aerosol (A)	Usually contain small amounts of a.i. and a petroleum solvent. Two main types: 1. Ready-to-use small pressurized containers. 2. Fog generators are not under pressure; equipment breaks the liquid into fine mist or fog.	Mixing not usually required. Low concentration of a.i.	Inhalation hazard. Pressurized containers hazardous if punctured.	1. "Spray cans" used mainly for home/garden insecticides. 2. Used in greenhouses or for mosquito control.
Emulsifiable concentrate (EC or E)	Contains a.i., petroleum solvent, and emulsifiers. Pesticide is suspended in spray which is milky coloured	Easily mixed. Non-abrasive.	May cause leaf burn, be flammable or easily absorbed through skin.	Sprays for insect, disease, and weed control.
Flowable (F)	Finely ground particles suspended in an inert liquid carrier. Forms suspension in spray mix like WP.	No dust. Pre-mix not needed.	Needs agitation before and after mixing as a.i. may settle out. Abrasive, wears nozzles.	Sprays for insect, disease and weed control.
Gel	Semi liquid emulsifiable concentrate	Used with water soluble packaging.	Cannot measure amounts smaller than package size.	Herbicides and insecticides.
Micro-encapsulated Materials	Consist of pesticide surrounded by a plastic coating. Mixed with water and sprayed. Breaks down slowly.	Reduced hazard to applicator. Easy to mix and apply.	Agitation needed. Can be very hazardous to bees.	Insecticide and pheromone sprays.
Solution (SN)	a.i. dissolved in liquid. Forms a solution in spray mix.	Easily mixed. Non-abrasive. Agitation not needed.	High concentration of a.i. may increase mixing hazard.	Sprays for weed control.
Ultra low volume concentrate (ULV)	Liquid with very high concentration of a.i. Designed to be used as is or slightly diluted in ULV equipment.	Requires little or no mixing. Few products available.	Needs special application equipment.	Insecticide sprays inside greenhouses or for forestry.
<b>Gases</b>				
Fumigants	Volatile liquids or solids packaged to release a toxic gas.	Toxic to many types and stages of pests. Good penetration of structures and soils under proper conditions.	Highly toxic. Treated area must be well sealed.	Greenhouses, mushroom houses, graineries. Pre-plant soil treatment for soil-borne pests.
<b>Packaging</b>				
Water-Soluble Packets	Pre weighed amount of WP or SP formulation in a special plastic bag which dissolves in spray tank and releases contents.	Low applicator exposure during mixing and loading No container to dispose of.	All quantities are pre-measured and may not be the correct amount for a field.	