

What are pesticide formulations?

- A pesticide formulation is a mixture of chemicals which effectively controls a pest. Formulating a pesticide involves processing it to improve its storage, handling, safety, application, or effectiveness.¹ See the text box on Some Formulations.

What makes up a formulation?

- The pesticide formulation is a mixture of active and other ingredients (previously called inert ingredients). An active ingredient is a substance that prevents, kills, or repels a pest or acts as a plant regulator, desiccant, defoliant, synergist, or nitrogen stabilizer.⁴ Pesticides come in many different formulations due to variations in the active ingredient's solubility, ability to control the pest, and ease of handling and transport.
- Synergists are a type of active ingredient that are sometimes added to formulations.⁴ They enhance another active ingredient's ability to kill the pest while using the minimum amount of active ingredient, but do not themselves possess pesticidal properties. For example, insecticides containing the active ingredient pyrethrins often contain piperonyl butoxide or n-octyl bicycloheptane dicarboximide as a synergist.
- Other (or inert) ingredients may aid in the application of the active ingredient. Other ingredients can be solvents, carriers, adjuvants, or any other compound, besides the active ingredient, which is intentionally added.⁴ There are many types of other ingredients: solvents are liquids that dissolve the active ingredient, carriers are liquids or solid chemicals that are added to a pesticide product to aid in the delivery of the active ingredient, and adjuvants often help make the pesticide stick to or spread out on the application surface (i.e., leaves).⁵ Other adjuvants aid in the mixing of some formulations when they are diluted for application.

Some Formulations^{2,3}

A	Aerosol
B	Bait
D	Dust
DF	Dry flowable
E, EC	Emulsifiable concentrate
FL	Flowable
G	Granule
M	Microencapsulated
P	Pellet
RTU	Ready-to-use
SP	Soluble powder
ULV	Ultra-low-volume concentrate
WP	Wettable powder
WDG	Water-dispersible granule

What do manufacturers consider when creating a formulation?

- The type of surface, training, equipment, runoff, drift, habits of the pest, and safety are all considered when a manufacturer designs a pesticide formulation.³

Type of surface

- Some formulations are more effective on certain surfaces than others. Discoloration or pitting of the surface of plants or other surfaces may occur with some formulations.^{6,7}

Training and equipment

- Many pesticide products that the public purchases and uses are ready-to-use (RTU) formulations which require no dilution and can be applied quickly and conveniently. Examples of ready-to-use formulations used by homeowners are granules for insect and weed control and baits for rodent control.

NPIC fact sheets are designed to answer questions that are commonly asked by the general public about pesticides that are regulated by the U.S. Environmental Protection Agency (US EPA). This document is intended to be educational in nature and helpful to consumers for making decisions about pesticide use.

PESTICIDE FORMULATIONS

TOPIC FACT SHEET

- Many of the formulations used by farmers and commercial applicators (like pest control companies) need to be applied with certain equipment. These formulations may also require certification or training for individuals performing the application. For example, termiticide applicators may be required by the Department of Agriculture in each state to complete specific training in the use of termiticides.
- Some liquid pesticide formulations commonly used by farmers and commercial applicators are applied with a compressed air sprayer, fogger, or soil injector.⁶ Other liquid pesticide formulations used by farmers may require the use of aircraft, low pressure boom sprayer, high-pressure sprayer, or ultra-low-volume sprayer.⁶
- The equipment required for the application is listed on the label.

Runoff or drift

- Rain soon after the application may cause the pesticide to run off and contaminate lakes, rivers, streams, or ponds.⁷
- Wind may carry or drift the pesticide during the application onto adjacent property, bodies of water, people, or animals.
- Specific environmental precautionary statements may be present on the label describing how to avoid runoff or drift.

Safety to people, animals, and the environment

- Individuals who apply, handle, transport, or dispose of pesticides should know the proper manner in which to deal with them. Safety gear is important to minimize potential exposure to pesticides during an application. An applicator's proper personal protective equipment (PPE) may include a long sleeve shirt, pants, closed-toe shoes, chemically resistant rubber gloves, a respirator, and/or eye protection. The equipment required for an application will be listed on the label.
- In addition to the safety of those working with pesticides, the safety of people, pets, and the environment near the site of application need to be taken into account.⁷ To facilitate this, the label often has precautionary statements to protect wildlife and other non-target species.

Habits of the pest

- The pest needs to be identified. Information on how the pest feeds, its reproductive habits, and its life cycle will help the manufacturer determine which formulation would be the most effective.⁷

Can pesticides be mixed together?

- The pesticide product label will list any chemicals that it should not be mixed with (i.e., incompatible with) or containers that it should not be mixed in.⁴ For example, wettable sulfur should not be mixed with Lorsban or Morestan because they are incompatible.⁶
- Some pesticides can be mixed together (i.e., they are compatible with each other).
- Not all pesticides can be mixed together (incompatible) because they separate out of the solution, gel, curdle, or clog the equipment during application.
- Pesticides that are physically different (i.e., dust versus liquid) are typically incompatible.

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How are incompatibilities avoided?

- Verify with the pesticide label what types of pesticide formulations to avoid mixing. Formulated pesticide products that are ready-to-use (RTU) liquids and concentrated liquids that have been diluted according to label instructions can be mixed together. However, undiluted liquid concentrations should not be combined.
- To reduce incompatibilities of flowable, wettable powder, and water-dispersible granule formulations, regular shaking is needed.²
- If you have questions about compatibility or other pesticide-related issues contact your State Department of Agriculture or your local County Cooperative Extension Service for more information.

Date Reviewed: December 1999

References

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