Understanding pesticide formulations

By Steve H. Futch and Ryan Atwood

This is a CEU article that grants one core CEU when submitted and approved.

The pesticides that you purchase for application to agricultural crops consist of both active and inert ingredients. This mixture of active and inert ingredients is called the pesticide formulation. The active ingredient alone may not mix well with water; thus inert ingredients may be added to formulate the product.

The active ingredient (a.i.) is the substance in the pesticide product that is intended to kill, repel or otherwise control a target pest. The inert ingredients are the materials in the pesticide formulation other than the active ingredient. They are added to dilute the pesticide or to make it safer, more effective, and easier to measure, mix, apply, handle and store. Adjuvants within the pesticide formulation are premixed into the product to improve mixing, application or to enhance pesticide activity. Adjuvants can also be added later as pesticides are mixed into the spray solution. Inert ingredients do not provide any pesticidal activity.

In most pesticide applications, the formulated product will be mixed with water for final application. This spray mixture may contain several pesticide materials if the label does not prohibit the combination of specific multiple pesticide formulations.

The formulated pesticide product's brand name will be followed by an abbreviation that is used to describe the formulation, how it may be used, or characteristics of the formulation. Some of the common abbreviations seen on products labeled for use in citrus include: B (baits); DF (dry flowable); E or EC (emulsifiable concentrate); G (granules); L (liquid); SP (soluble powder or packet); or W or WP (wettable powder).

The amount of active ingredient is also stated on the label. In the case of a dry product, if the label states it is an 80 DF, it contains 80 percent by weight of active ingredient and the remaining 20 percent is inert ingredient. If the previously mentioned product was in a 5-pound bag, that bag would contain 4 pounds of active ingredient and 1 pound of inert ingredient. For a liquid formulation, the label indicates the amount of active ingredient per gallon of product. For example, 4E formulation indicates it contains 4 pounds of the active ingredient per gallon in an emulsifiable concentrate formulation.

Some pesticide formulations are available in different concentrations, like various types of "Roundup" that can be easily found in many lawn and garden centers. You should choose the one best fitted for the job you will be doing. As the concentration varies, the amount required for control of a specific pest will likewise vary.

LIQUID FORMULATIONS

Emulsifiable concentrates (E, EC, EW) usually contain a liquid active ingredient, one or more petroleum based solvents, and a product that is an emulsifier that allows the formulation to be mixed with water to form an emulsion. After mixing this type of product with water, the spray solution will usually have a white or milky appearance. Agitation of the spray solution is required to keep the product evenly distributed within the spray mixture.

Liquid or flowable formulations combine many of the characteristics of emulsifiable concentrates and wettable powders. The active ingredient in these products is a solid that is suspended in a small amount of liquid. The active ingredient does not dissolve in water. The formulated product is quite thick and may settle out or separate while in the original container. Prior to measuring these products, they should be shaken to ensure the product is evenly mixed in the container. When mixing these products into water, constant agitation must be applied to the spray mixture to keep them in suspension, producing a spray mixture that contains a constant rate of product in the spray volume. If the agitation is insufficient, the product will settle out of suspension and could possibly result in crop damage or insufficient pest control.

DRY FORMULATIONS

Bait (B) formulations contain the active ingredients that are mixed with a food or attractive substance. Pests are killed by eating the bait that contains the pesticide. The active ingredient in most bait formulations is usually less than 5 percent. In citrus, bait products are usually used to control ants or various fruit flies. Baits are not mixed with water for application.

In granular (G) formulations, the pesticide is applied to coarse particles that are made from material such as clay, corncobs or other materials. The active ingredient usually ranges from less than 1 percent to 15 percent by weight. Granular formulations are applied to the soil surface or incorporated into the soil. When granular formulations are applied for ant control, special care may be required to apply the material when the ants are actively feeding and avoid applications when dew or rain is forecast because moisture can make the product less likely to be consumed by the ants.

Wettable powders (WP) are dry, finely ground formulations that are mixed with water for application. Wettable powder products may contain active ingredients ranging from as low as 5 percent to more than 95 percent by weight. When mixed with water, they settle out quickly unless agitation is constantly applied to the spray solution.

Dry flowable (DF) formulations are similar to wettable powders except they are formulated as small granules that produce less dust when measured or mixed as compared to wettable powders. Dry flowable formulations are mixed with liquid materials for application. These formulations require constant agitation to keep the materials suspended in the spray solution. The percentage of active ingredient by weight is usually high, greater than 90 percent for many products.

Soluble powder (SP) formulations look like wettable powders. However, when mixed with water they dissolve readily and form a true solution. After thorough mixing, additional agitation is not required to keep the material in suspension.

Water-soluble packets (WSP) are used to reduce the mixing and handling hazards of some pesticide products. The formulated material is contained in a special water-soluble bag that dissolves when placed into water.

ADJUVANTS

Adjuvants are materials that are used with pesticides to enhance their performance. By themselves, adjuvants do not provide pest control. These materials may be premixed into the pesticide formulation or added at the time of mixing the pesticide formulation in the spray tank. Adjuvants include surfactants, compatibility agents, anti-foaming agents, spray colorants, drift control agents, etc. Care should be used when selecting an adjuvant because pesticide performance can be impacted by the adjuvant selected.

Care should be used when selecting, mixing and applying any pesticide to ensure all requirements on the label are followed. The label will specify

rates, target crops, the pest controlled, personal protective equipment required, as well as other requirements and restrictions. **Remember, the label is the law.**

Source: Applying Pesticide Correctly. Fred Fishel, editor. University of Florida, IFAS Extension at Gainesville.

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'Understanding pesticide formulations' test

To receive one core continuing education unit (CEU), read "***Understanding pesticide formulations"*** in this issue of *Citrus Industry* magazine. Answer the 20 questions on the magazine's Web site (www.citrusindustry.net) or mail the answers and application information to the address at the bottom of the form. The article and test set will be valid for up to one year from the publication date. After one year, this test will no longer be valid for granting CEUs.

1.	*Pesticide formulations contain active and soluble ingredients.*	T	F
2.	*Inert ingredients may be added to the pesticide formulation to improve handling and storage.*	T	F
3.	*The inert ingredient is the substance intended to kill or repel the target pest.*	T	F
4.	*Adjuvants are considered active ingredients in pesticide formulations.*	T	F
5.	*A formulated pesticide product brand name will be followed by an abbreviation to describe characteristics of the formulation.*	T	F
6.	*A product that is listed as an 8DF will contain 8 pounds per gallon of formulated product.*	T	F
7.	*Pesticide formulations with the same brand name will not vary by concentration.*	T	F
8.	*Emulsifiable concentrates can't be mixed with water for application.*	T	F
9.	*Liquid and flowable formulations have many of the same characteristics as emulsifiable concentrates.*	T	F
10.	*Liquid and flowable formulations do not need agitation to keep the product in suspension.*	T	F
11.	*Liquid and flowable formulations should be shaken to ensure product is evenly mixed within the container prior to measuring the product.*	T	F
12.	*Bait formulations kill the pest when they eat the material.*	T	F
13.	*When manufacturing granular formulations, the pesticide can be applied to clay or corncobs to make the formulated product.*	T	F
14.	*Wettable powders are coarsely ground formulations that will be mixed with water.*	T	F
15.	*Soluble powder formulations look like wettable powders.*	T	F
16.	*Soluble powder formulations form a true suspension when mixed with water and do not require agitation to keep the pesticide in suspension.*	T	F
17.	*Water-soluble packets are used to reduce the mixing and handling hazards of some pesticides.*	T	F
18.	*Adjuvants are materials used to enhance the performance of a pesticide mixture.*	T	F
19.	*Adjuvants provide pest control when applied alone.*	T	F
20.	*The label is the law.*	T	F

Pesticide Applicator CEU Form

First Name: _____ Last Name: _____

Email: _____

Pesticide License Number _____

Address _____

City _____ State _____ Zip: _____

Phone Number: _____

Please mail the answer sheet or a copy of the form to: Dr. Steve Futch, Citrus Research & Education Center, 700 Experiment Station Road, Lake Alfred, FL 33850.

If you have questions regarding this form, test or CEUs, contact Steve Futch at shf@ufl.edu or call (863) 956-1151, ext. 1202.