What do pesticide formulations have to do with anything?

By Laurie Ann Hurner

This CEU article grants one General Standards (Core) CEU when submitted and approved toward the renewal of a Florida Department of Agriculture and Consumer Services restricted-use pesticide license.

hat is a pesticide? According to Webster's Dictionary, the simple definition of a pesticide is "an agent used to destroy pests." In the commercial citrus industry today, we could not produce a



ACTIVE INGREDIENT: Permethnin: (*3-Phenoxypheryl) methyl (2) cis/trans 3-(2,2-dichloroethenyl)-2,2-dimethylox/opropanecarboxylate]..... 2.5% OTHER INGREDIENTS 97.5% 100.0% Total cis/trans isomer ratio: Min 35% (±) cis Max 65% (±) trans

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The chemical label indicates the active ingredients.

profitable crop without using various forms of pesticides. Florida's humid climate, where rain and heat are a normal occurrence, allows us to produce high-quality citrus fruit. However, it also encourages pests and disease as Florida's environment is ideal for their development and survival.

Pesticide chemicals in their pure or clean states (also called the active ingredient or a.i.) are not easily used for crop protection. Many of the pure chemicals are too concentrated for application. The active ingredient may not mix well with water, may be too volatile to transport or too toxic to handle by humans. Therefore, chemical active ingredients are mixed with inert/inactive ingredients so that they are usable by the grower to safely apply to crops.

What is an inert ingredient? Inert ingredients are "all materials in the pesticide formulation other than the active ingredient. They are added to dilute the pesticide to make it safer, more effective, and easier to measure, mix, apply and handle. Some inert ingredients may be toxic or hazardous to people."

FORMULATION INGREDIENTS

The mixture of the chemical and the inert/inactive ingredients is called the pesticide formulation. Formulations

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contain the active ingredient, inactive ingredient and, many times, other ingredients that help make the application more efficient and effective in controlling the target pest or pests.

Adjuvants, often referred to as spreader-stickers, are chemicals that are either premixed with the active chemical or added to the spray tank to help improve mixing and application of the chemical. Adjuvants alone do not possess pesticidal activity.

Many times, people confuse the term adjuvant and surfactant. These two terms can be used interchangeably, but they do not always mean the same thing. These terms can refer to the same product because all surfactants are adjuvants. However, not all adjuvants are surfactants.

Always follow the label when using surfactants. The label will state if specific surfactants are required as well as the applicable rates to mix into the spray solution.

Dyes and stabilizers may also be added to the tank mix to make it easier for the applicator to see where the product has been applied to ensure that the best possible coverage is achieved. Typically, a carrier will be added to the tank mix to assist the active ingredient in staying in suspension and to move easily from the tank onto the trees, plants or other application area. Usually, the carrier is some type of organic solvent or mineral clay. The final ingredient that is needed for most pesticide applications is water or oil.

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Often, an applicator can find the same active ingredient sold in many different types of formulations. The applicator should make sure to apply the active ingredient in the formulation that is the best one for the job. The table on page 41 is a great resource for formulation abbreviations.

FORMULATION SELECTION

Before choosing a formulation, an applicator must ask the following questions:

- Is the necessary application equipment and personal protective equipment available?
- Can the formulation be applied appropriately under the conditions



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in the application area?

- Will the formulation reach the target and stay in place long enough to control the pest?
- Is the formulation likely to damage the surface to which it will be applied?
- Can a less hazardous formulation be chosen that will still be as effective?

These questions should be relatively easy to answer and should build the case for which formulation to use. There are three basic classes of pesticide formulations: liquid, dry and other. Let's take a minute to dive more into each formulation class.



A pesticide applicator should always review application information prior to application.

Liquid formulations are usually mixed with water, but may in some circumstances be mixed with diesel fuel, kerosene or some other light oil as a carrier. Common liquid formulations are:

• Emulsifiable concentrates contain liquid active ingredients and one or more petroleum-based solvents. The product must also contain an emulsifier which will allow the formulation to mix with water and form an emulsion. Emulsifiable concentrates are usually easy to handle, transport and store. One disadvantage is that they usually contain a high amount of active ingredient, so it is easy to overdose or underdose through mixing or calibration errors.

- **Solutions** are active ingredients that dissolve readily in a liquid carrier and do not usually settle out or separate.
- Ultra-low volume concentrates may approach 100 percent active ingredient and are designed to be used "as-is" or to be diluted with very little of a specific carrier. These products are very easy to transport. However, they have very high drift potential since the sprayed particles are so small.
- Flowables/liquids contain active ingredients that are solid and do not dissolve in either water or oil. The active ingredient is impregnated on a substance such as clay, which is ground to a very

fine powder, and then the powder is suspended in a small amount of liquid. Flowables must remain in suspension and leave a residue wherever they are sprayed.

Dry formulations are generally sold as ready-to-use products (dusts) or concentrate forms that must be mixed with water to be applied. Common dry/solid formulations are:

• Wettable powders are dry, finely ground formulations that look like dust. They need to be mixed with water before spraying. Wettable powders may contain between 5 and 95 percent active ingredient and do not dissolve in water. They settle out quickly and require constant agitation to keep



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them in suspension.

- Soluble powders look much like wettable powders, yet when mixed with water, dissolve readily and form a true solution. After they are thoroughly mixed, no more agitation is necessary. Very few pesticides are available in this formulation due to the fact that few active ingredients are readily soluble in water.
- Baits contain an active ingredient mixed with food or another attractive substance. The bait either attracts the pests or is placed where the pests will find it. Pests are killed by eating the bait that contains the pesticide. The biggest advantage of a bait is that it comes ready-to-use and you do not have to cover an entire area to be effective. The huge disadvantage is that baits can be attractive to children and pets and may kill domesticated animals or nontarget wildlife outdoors.
- **Dusts** mostly come ready to use and contain a very small amount of active ingredient. The carrier in dust products is usually talc, chalk, clay, nut hulls or volcanic ash. The downside to dusts is that they easily drift off target during application and may irritate eyes, nose, throat and skin.

Other formulations are a special group of products that really do not fall into either of the previous categories:

- Water-soluble packets reduce the mixing and loading of highly toxic products. Wettable powder and soluble powder formulations in precise amounts are placed into bags that are simply dropped into a filled spray tank while the mixing process is being conducted. The bag readily dissolves, and the pesticide is then safely released into the mix.
- **Repellents** are available in aerosol and lotion formulations. These products are applied to skin, clothing or plant foliage to repel biting and nuisance insects.
- **Pesticide/fertilizer combinations** include many fungicides,

Abbreviation	Interpretation
Α	Aerosol
AF	Aqueous flowable
AS	Aqueous solution or aqueous suspension
В	Bait
С	Concentrate
CG	Concentrate granules
СМ	Concentrate mixture
D	Dust
DF	Dry flowable
DS	Soluble dust
E, EC, or EW	Emulsifiable concentrate
F	Flowable (liquid)
G	Granules
GL	Gel
L	Liquid (flowable)
LC	Liquid concentrate or low concentrate
M or ME	Microencapsulated
MTF	Multiple temperature formulation
P or PS	Pellets
RTU	Ready to use
S	Solution
SD	Soluble dust
SG	Soluble granule
SP	Soluble powder or soluble packet
тс	Termiticide concentrate
ULV	Ultra-low volume
W or WP	Wettable powder
WDG	Water-dispersible granules
WS	Water soluble
WSB or WSP	Water-soluble bag, water-soluble powder or water-soluble packet
WSG	Water-soluble granules
WSL	Water-soluble liquid

Formulation abbreviation table.

insecticides and herbicides that can be used in combination with fertilizers. This is a convenient way to get multiple things done at the same time, which saves money and manpower. Unit cost of these formulations is usually high, but they are convenient.

• Fumigants are pesticides that form gasses or vapors toxic to plants and micro-organisms. Some of these active ingredients are formulated, packaged and released as gasses, and others are liquids that are packaged under high pressure and change to gasses when they are released. Fumigants are used for structural pest control as well as for agricultural pest control. Fumigants may be used in soil, greenhouses, granaries and grain bins.

CONCLUSION

So to answer the question ("What do pesticide formulations have to do with anything?"), formulation has something to do with everything. The pesticide applicator must consider several factors when choosing a pesticide formulation based upon the target crop, pest, application method and environmental and site conditions. The applicator needs to consider things such as risk associated with the formulation type, practicality of using that formulation on the site and whether that formulation will provide the





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Phone (352) 671-1909 Gary@AgNetMedia.com Bob@AgNetMedia.com control needed for the current pest situation. Proper selection of a pesticide formulation will help the applicator be efficient and effective as well as assist with mixing, loading and applying the material in the safest way possible.

Source: Applying Pesticides Correctly (SM1) by Fred Fishel, published by the University of Florida.

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Mail the answer sheet or a copy of the form to:

Laurie Ann Hurner UF/IFAS Extension Highlands County, 4509 West George Blvd., Sebring, FL 33875

If you have questions regarding this form, test or CEUs, e-mail Laurie Ann Hurner at Ihurner@ufl. edu or call 863-402-7150. Please allow two weeks to process your CEU request.

Coming Events

August 17–18

Citrus Expo, Lee Civic Center, North Fort Myers; see pages 20-31 and www.CitrusExpo.net

August 25

Citrus Packinghouse Day, Indian River Research and Education Center, Fort Pierce

August 25–26

Florida Agriculture Financial Management Conference, The Omni Orlando Resort at ChampionsGate, see www.fafmc.org

September 18–23 International Citrus Congress, Mabu Thermas & Resort, Foz do Iguaçu, Brazil, see www.icc2016.com

September 20–23 International Citrus & Beverage Conference, Sheraton Sand Key Resort, Clearwater Beach, see http:// conference.ifas.ufl.edu/citrus/ index.html

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'What do pesticide formulations have to do with anything?' test

To receive one Core continuing education unit (CEU), read "What do pesticide formulations have to do with anything?" in this issue of *Citrus Industry* magazine. Answer the 20 questions on the magazine's website (www.citrusindustry.net) or mail the answers and application information to the address to the left of this test. The article and test set are valid for up to one year from the publication date. After one year, this test will no longer grant a CEU.

1. 2	The posticide formulation is the event used to control or kill posts	т Т	Г	
2. 3	Pesticide chemicals in their pure or clean states are also called active	1	г	
5.	ingredients or a.i.	Т	F	
4.	A common ingredient needed in most pesticide formulations is water or horticultural oil.	Т	F	
5.	ULV is the abbreviation for ultra-low volume, which contains active ingredients that are solid and do not dissolve in water or oil.	Т	F	
6.	Emulsifiable concentrates always contain one or more petroleum- based products.	Т	F	
7.	There are five basic classes of pesticide formulations.	Т	F	
8.	One advantage to using solutions is that their active ingredients never dissolve readily in a liquid carrier so they always settle to the bottom.	Т	F	
9.	Fumigants are pesticides that form gasses or vapors toxic to plants and micro-organisms.	Т	F	
10.	 Pesticides should never be combined with fertilizers because you will not know how much actually was delivered to the plant. 			
11.	Inert ingredients are never hazardous to people, plants or animals.	Т	F	
12.	2. Dyes and stabilizers help the applicator see where the product has been applied and if coverage is complete.			
13.	 Pesticides are used most efficiently by the plant when no inert/inactive ingredients are mixed with the pure chemical. 			
14.	4. An applicator will place a carrier into the pesticide tank mix to assist the active ingredient in staying in suspension and to move easily from the tank onto the application area.			
15.	Wettable powders require constant agitation to keep them in suspension.	Т	F	
16.	 All pesticide formulations require constant agitation to keep them in suspension. 			
17.	 Liquid formulations are usually mixed with water, but can also be mixed with other carriers based upon the pesticide label. 			
18.	8. Dusts contain a high percentage of active ingredient.			
19.	 Dry formulations are never sold as ready-to-use products and must always be mixed with a carrier to be applied. 			
20.	Some active ingredients do not mix well with water and are too toxic to be handled by humans.	Т	F	
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