

# Pesticide formulations

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**T**his article is the second in a four-part series on general pesticide principles required for the safe use and application of pesticides. The article and subsequent test have been approved for one continuing education unit (CEU) in the core category for pesticide license renewal. The article and test set will be valid for up to one year from the publication date. After the one-year period, they expire and the CEU credit will no longer be available.

## PESTICIDE FORMULATION

Each pesticide that is purchased for use in the United States will have an Environmental Protection Agency (EPA) approved label attached to the product container. The information contained on the label will clearly identify how the product can be used and what pests are controlled when applied as directed. The label will also include specific information as to the required personal protective equipment (PPE) to be worn at the time of application as well as the restricted entry interval (REI) and preharvest interval (PHI) requirements.

Near the beginning of the label will be a statement referring to the ingredients that make up the product. This section will be divided into the active and inert ingredients. Active ingredients in the pesticide are the chemical or chemicals that control the target pest. The inert ingredients do not provide pest control and are used to: 1) dilute the pesticide; 2) make it safer, easier to measure, mix or apply; and 3) improve the handling convenience.

The mixture of both the active and inert ingredients forms the pesticide formulation. The pesticide's active ingredient is usually diluted with water, petroleum solvent or other diluents that may be wetting agents, spreaders or stickers that enhance product efficacy. Depending on the active and inert ingredient concentration, the product may be in a form that is ready to use or may require additional dilution prior to application. The label will provide suggested spray volumes that should be applied when using the product. To apply the pesticide in a volume not listed on the label is a violation of the pesticide label as well

as the law.

When looking at the label, one should pay special attention to the directions. Differences in the percent active ingredient can exist between brand names. A good example of various concentrations for the same brand name would be the many different types of glyphosate (Roundup, Touchdown, Glyphosate, Credit, etc.). This concentration difference would require adjusting the amounts of the selected product to be mixed into the spray solution to obtain adequate control of the pest.

## LIQUID FORMULATIONS

In the citrus industry, you will find various liquid pesticide formulations. Some of the more common types of liquid pesticides are emulsifiable concentrates (EC or E); flowables (F or L); solutions (S); or, ultra-low volume (ULV). Each of these products has advantages and disadvantages that will affect their use.

The emulsifiable concentrate product will usually contain the active ingredient, a petroleum-based solvent, and an agent to allow the product to be mixed with water. These liquid products are usually 25 percent to 75 percent active ingredient and will be noted as a 2 to 8 E or EC. The number before the E or EC indicates the pounds of active ingredients per gallon, which usually ranges from 2 to 8 pounds of active ingredient per gallon. These formulations are used in a wide range of application equipment and crops treated. The advantages of these products are that they are easy to handle and mix into the spray solution. Disadvantages are that by having an emulsifying agent, the product may be easily absorbed through the skin and requires specific protective equipment to be worn during application to minimize this risk.

Products that consist of insoluble, finely ground active ingredients that have been mixed with liquid material to form a suspension will be identified as flowables. The flowable materials will have the letter F following the brand name and are similar to EC products in their ease of use and in pounds of active ingredient per gallon. These products would then be mixed with water, but would require

constant agitation to keep the product adequately mixed.

The brand name of a pesticide product that is a solution will be followed by the letter S. These products contain an active ingredient that has been dissolved into water or petroleum-based solvent. These products when mixed into the spray solution form a solution that does not settle out or separate, thus requiring little agitation once thoroughly mixed.

Ultra-low volume (ULV) materials have not been frequently used in citrus in the past, but their use is increasing recently due to lower volume spray application being promoted for psyllid control. ULV products have a high percentage of active ingredients per unit volume or weight and may approach 100 percent. When applied, they may be used as straight product or mixed with only a very small quantity of solvent or water. Historically, they have extensively been used for mosquito control programs. These types of products are easily absorbed through the skin.

## DRY FORMULATIONS

Dry formulations frequently used in citrus include: dust (D); granules (G); and, wettable powders (WP or W). The percent of active ingredient varies greatly between products. For dry formulations, the number before the D, G, WP or W will indicate the percent of active ingredient per pound of product; thus an 80 WP would contain 80 percent active ingredient (AI) per pound of product (0.8 pound AI per pound of product).

Dust formulations are usually never mixed with water and applied as a dry powder during application. They contain a very low percent active ingredient and usually range from one-half percent to 10 percent with a finely ground carrier. Dust formulations can easily drift from the intended site during application. Thus additional care should be used to minimize off-site movement.

Granule formulations are usually larger particles that are heavier than dust formulations. The percent of active ingredient is low and usually ranges from 1 percent to 15 percent. Depending on the pesticide formulation, the product may be applied as bait or to the soil to control various

pests. In the case of Temik 15G, the product must be incorporated into the soil at the time of application and only applied once per season and during the period of time between Nov. 15 and April 30.

### **ADJUVANTS**

To increase the effectiveness or safety of a pesticide formulation, products may be mixed with an

adjuvant prior to application. Some of the more common adjuvants are surface tension reducing active ingredients that are referred to as surfactants. Adjuvants can be wetting agents, emulsifiers, spreaders, stickers, penetrants, foaming agents or buffers. These products may aid in mixing the pesticide formulation with water, creating a more uniform application on the treated surface,

penetrating into the treated surface or modifying the acidity or alkalinity of the spray mixture.

When using any pesticide, growers and applicators are required to read the label and follow the directions for use. Remember that the pesticide label is the law.

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