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Not all pesticide formulations are created equal

The quality of inert ingredients can have a tremendous impact on the overall performance of chemical control products.

Never before have commercial growers had access to such a wide selection of control products and different registered active ingredients. As more of these active ingredients come-off patent there will be an increase in the number of products available from post-patent companies.

As more off-patent products are released, it's important that growers understand that not all pesticide formulations are created equal. This is particularly important for ornamental growers, who produce some of the most valuable crops on a per-acre basis.

What to know about inerts

The term "inert" is used by regulatory organizations to distinguish those chemistries in a product that are not participating directly in a biochemical interaction to control a particular pest. The term can be a bit misleading as these ingredients are not simply filling space, but play a key role in effectively delivering an active ingredient to a crop.

A key aspect of any pesticide formulation is most active ingredients available today are not very water-soluble and, in fact, can be extremely hydrophobic or "water-fearing." Simply put, an active ingredient is not very effective in a spray tank if used alone. Inert materials are absolutely vital to turning active ingredients into user-friendly products that can be easily mixed in water and applied with strong biological performance. This is a common characteristic, and it applies to most active ingredients even if they are very viscous oils or solids with a variety of crystal forms, structures and shapes.

Typical inert ingredients in agrochemicals products are:

- **Surfactants.** Given that many active ingredients are hydrophobic, surfactants function as wetting agents to allow the surface of active ingredient crystals to be "wetted" by water. Some surfactants can be polymeric, meaning they are made up of long chains of molecules, and function as dispersants to keep particles from aggregating or sticking together.
- **Thickeners.** As most active ingredients have a higher density than water, associative thickeners are needed to build structure in the product and prevent the active ingredient particles from settling out in the package container.
- **Preservatives.** Preservatives are added to chemical products to prevent the growth of microbes which can digest thickeners, resulting in the settling out of active ingredients.
- **Anti-foams.** Anti-foams can be important in preventing the formation of stable foam in a spray tank which can cause application problems.
- **Antifreeze.** Antifreeze agents allow products to withstand freeze-thaw cycles.
- **Rainfastness agents.** Rainfastness agents allow contact products to remain on leaf surfaces.
- **Adjuvants.** These can be incorporated to help improve active ingredient efficacy.

The types of inert ingredients needed for a product depend on the active ingredient, formulation type and any potential those inerts may have to cause phytotoxicity or damage to target crops.

The quality of an inert can have a tremendous impact on the overall performance of a product. All inerts used in pesticide formulations must be approved for use by EPA.

Effects/roles of inerts

The most common formulation types are suspension concentrates (SC), water dispersible granules (WG), emulsifiable concentrates (EC) and microemulsifiable concentrates.

Formulation can impact the user-friendliness of pesticide products. The physical properties during storage are highly dependent on the formulation. For example, a poorly designed flowable formulation could exhibit irreversible thickening or the formation of hard-packed sediment over time.

Inerts can affect tank mix compatibility, how well active ingredients resuspend after settling out in a spray tank and compatibility with application equipment. Given all the possible combinations, compatibility testing requires a significant amount of resources from manufacturers and a strong knowledge of the various types of tank mixers used in the industry.

Incompatibility can result in the formation of large clumps or aggregates of particles/droplets as well as phytotoxicity. An example of this is when an inert ingredient in a systemic product enhances transport of a contact product across the leaf cuticle causing injury. Inert ingredients can impact the safety profile of a product, requiring toxicity testing of the formulation in addition to the active ingredient alone.

Post-patent products

When regulatory packages are submitted to EPA, the formulation details are contained in the Confidential Business Information section. The formulation recipe is known only by the manufacturer and EPA. Other companies, including post-patent suppliers, do not have free access to the formulation recipe and must develop or outsource development of their own formulations.

Basic chemical manufacturers have more years of experience working with the active ingredients they developed than post-patent companies would for the same molecule. This experience is critical to understanding technical aspects of the active ingredient needed to formulate the highest performing product possible.

It's important for growers to know that formulation characteristics such as particle size, tank mix compatibility, ease of handling and mixing, resistance to micro-


bial contamination and long term physical stability of the formulation are not regulated. It is up to the manufacturer's technical strength and industry stewardship to optimize these formulation properties. When post-patent companies want to register a product based on the basic manufacturer's registration (sometimes called a "me-too" registration), they are not required to submit efficacy data for their formulations. The post-patent companies can merely cite the basic manufacturer's data. It is possible for a post-patent company to sell a product that has never actually been commercially field tested.

Formulations are highly complex systems that are critical for the safe and effective delivery of active ingredients to crops. Inert ingredients and processing parameters impact a grower's overall experience with a product. Processing parameters refer to a manufacturer's behind-the-scene efforts during product

development to ensure optimal formulation performance, including particle size, suspension concentrate and handling and mixing testing.

When buying pest control products, growers should consider more than price. They should consider a manufacturer's reputation, its depth of scientific resources and industry dedication, and other support tools it offers to ensure a grower's business success.

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<p>ONLINE EXTRA: For more details on inert ingredients and formulation types visit:</p>	
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