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# AGRONOMY ANSWERS

**DuPont**  
Crop Protection

## PESTICIDE FORMULATIONS AND MIXING

Herbicides, insecticides and fungicides are sold in many different types of formulations and to ensure they mix properly in spray solution it's important to understand how they behave, along with using the proper mixing order. This article will address these points.

A particular formulation will be chosen for a pesticide for several different reasons; sometimes more than one formulation will be commercially available. Reasons for choice of a particular formulation will include: applicator safety, environment(s) in which the product typically will be used, biology of the pest(s) as well as crop(s), properties of the active ingredient, cost, spray equipment typically used in the target market and customer needs and expectations.

Each formulation will begin as either a liquid or dry active ingredient that's either water-soluble or not. If not water-soluble, the formulation choice might be liquid as an EC, SC or OD. Or the choice might be dry as a WG or WP. If the active is water-soluble, the formulation choice might be SL or SG. There are other less common formulations such as tablets, suspoemulsions and emulsions in water. Formulations commonly sold in Western Canada include:

- **Soluble Concentrate (SL)** e.g. glyphosate, Liberty®, Banvel® II. These are fairly simple formulations where water is the solvent and a water-soluble active is dissolved in the water.
- **Emulsifiable Concentrate (EC)** e.g. Assure® II, Perimeter® II, Harmony® Grass, Vertisan®. EC's are a little more complex where an active that is not water-soluble is dissolved in an oil based solvent and an emulsifier is added to prevent oil and water from separating.
- **Suspension Concentrate (SC)** e.g. Acapela®, Coragen®, Varro™, Proline®. SC's are also more complex where the water-insoluble active is finely ground and suspended in water. These formulations may also contain a wetting agent, dispersing agent, structuring agent and other ingredients. It's important to remember the word suspension or dispersion; in either situation a suspension or dispersion means the active does not go into solution and is suspended or dispersed in the tank mix. These formulations require attention to mixing and agitation, especially if they have to sit for extended periods.
- **Oil Dispersion (OD)** e.g. Simplicity™, Travallas™. An OD is very similar to an SC except the solvent is an oil.
- **Soluble Granule (SG)** e.g. Express® SG, Barricade® SG, Pinnacle® SG. While SG formulations start out dry, *when mixed properly, they go totally into solution.*
- **Water Dispersible Granule or Dry Flowable (WG / DF)** e.g. Sencor® Solupak®, Muster®, Solo®. These are dry granular formulations that go into suspension after dispersion in water and are prone to settle out if left without agitation. Close attention is needed with these formulations when cleaning the sprayer.

Some formulations require addition of a surfactant to optimize the biological performance. The surfactant may be provided in the packaging (Assure® II and SureMix®), or some manufacturers choose to sell the surfactant separately. In some cases surfactant may be required only when mixing with a specific partner (e.g. Barricade® II + Varro™ or Horizon® NG). Since water pH can affect solubility and mixing of some pesticides, some formulations require a separate additive or pH adjuster be added to the spray tank (Assert® and pH adjuster). With other products pH modifiers can potentially cause mixing issues and are not recommended (Express® brands and CleanStart®). Bottom line is to always consult the product label or call if in doubt.



Mixing order can be critical to ensure rapid, easy mixing and minimize downtime. There are several ways to remember mixing order, however, the label is always your best guide. Here are some basic rules, keeping in mind there are always a few exceptions:

- W.A.L.E.S. = Wettables, Agitate, Liquids, EC’s, Surfactants
  - Dry products (SG, WG, DF, WP) in the tank first, **always**, followed by
  - SL products, then SC products, then EC or OD products,
  - then surfactants (exception with Liberty® and clethodim)
  - Additives where required (exception is pH adjuster added before Assert®)
- The desire is to disperse, suspend or dissolve the dry products first so that they don’t become coated with oil before they have a chance to mix. Then add the liquid products most compatible with water, followed by the least compatible with water. Lastly, surfactants and anti-foamers can go in the tank. Consult mixing instructions on pages 14-15 of 2016 Sask / MB Guide to Crop Protection
- Or pages 12-14 of 2015 Crop Protection (Alberta Blue Book)

Additives such as foliar fertilizers will be addressed in a subsequent issue of Agronomy Answers.

Always remember a little time spent properly mixing saves a lot of time unclogging a plugged sprayer. Time, adequate clean water in the spray tank or handler, and proper mixing order should make pesticide mixing go smoothly.

*For more information on pesticide formulations and mixing, or on any DuPont product, feel free to call or drop us a line. We look forward to hearing from you and welcome your feedback at any time.*

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As with all crop protection products, read and follow label instructions carefully.  
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