# Understanding Pesticide Formulations in Urban Pest Management

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Plunkett’s Pest Control  
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## LIQUIDS

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<tr>
<th>FORMULATION</th>
<th>DESCRIPTION</th>
<th>ADVANTAGES</th>
<th>DISADVANTAGES</th>
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</table>
| Emulsifiable Concentrates (EC) | • Usually contain an oil-soluble liquid active ingredient in one or more petroleum-based solvents with a mixing agent.  
• Most contain between 2 and 6 pounds of active ingredient per gallon.  
• Among the most versatile formulations. | • Relatively easy to handle, transport, and store.  
• Easy to pour and measure.  
• Little agitation required; will not settle out or separate when equipment is running.  
• Not abrasive; does not cause excessive equipment wear.  
• Will not usually plug screens or nozzles.  
• Leave little visible residue in treated surfaces. | • High concentration of active ingredient(s) makes it easy to overdose or underdose through mixing or calibration errors.  
• May damage treated plants or surfaces  
• Easily absorbed through skin of humans or animals.  
• Splashes and spills are relatively difficult to clean up and/or decontaminate.  
• Many have a strong odor.  
• Solvents may cause equipment “wear and tear.”  
• May cause pitting or discoloration of painted finishes or other treated surfaces.  
• Flammable; should be used and stored away from heat or open flame.  
• May be corrosive. |
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| Solutions (S)          | • Active ingredient dissolves readily in a liquid solvent.  
                          • Will not settle out or separate.  
                          • Suitable for any type of sprayer.  
                          • Formulated as Ready-to-Use and Concentrates. | • Relatively easy to handle, transport, and store; easy to pour and measure.  
                          • No agitation necessary.  
                          • Not abrasive; does not cause excessive equipment wear.  
                          • Do not plug screens or nozzles.  
                          • Do not usually leave visible residues on treated surfaces. | • Limited availability, especially water-based solutions.  
                          • Spills and splashes may be difficult to clean up and/or decontaminate.  
                          • Some are easily absorbed through the skin. |
| Liquid Baits           | • Most are concentrated sugar or protein solutions.  
                          • Typically packaged in ready-to-use bait stations.  
                          • Useful in sites where sanitation is poor because traditional food-based baits “compete” with other food sources.  
                          • Must place bait stations in safe, strategic locations. | • Very useful in controlling sugar-feeding ants.  
                          • Liquid rodenticide baits will often control rodents in areas where food is abundant, but water is scarce or lacking altogether. | • Not all pests will feed on liquid baits.  
                          • You must refill or replace liquid-containing bait stations frequently. |
| Ultra Low Volume (ULV) | • Have almost 100% active ingredient.  
                          • Designed to be used “as is” or diluted with only small quantities of specified solvents.  
                          • Applied as very fine droplets at very low rates per unit area (or volume). | • Relatively easy to handle, transport, and store.  
                          • Little or no agitation required.  
                          • Not abrasive to equipment.  
                          • Do not plug screens and nozzles.  
                          • Leave little visible residue on treated surfaces | • High drift hazard due to small droplet size.  
                          • Specialized equipment required.  
                          • Easily absorbed through skin of humans or animals; high dermal and inhalation exposure risk.  
                          • Products and/or solvents may cause rubber or plastic hoses, gaskets, and pump parts and other surfaces to deteriorate.  
                          • Calibration and application must be performed with special care because ULV products are applied in concentrated form. |
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| Flowables (F or AF) | - Contains tiny particles of active ingredient suspended in a liquid (usually water) and milled to reduce the average particle size.  
- Combine characteristics of liquid emulsifiable concentrates and dry wettable powders. | - Easy to handle and apply; low exposure risk.  
- Generally, not phytotoxic.  
- Seldom clog nozzles.  
- Splashes are less likely than with other liquid formulations. | - May settle; need shaking before measuring and mixing.  
- Difficult to remove all of product from the container. Containers may be difficult to rinse.  
- Require moderate agitation.  
- May be abrasive; contribute to “wear and tear” of spray application equipment.  
- Spills may be harder to clean up.  
- May leave a visible residue on treated surfaces. |
| Aerosols (A) | - Contain one or more active ingredients and a solvent.  
- Most contain a low percentage of active ingredient.  
- Two types:  
  o ready-to-use  
  o fog generators | - Easy to use; convenient.  
- Portable.  
- Easily stored.  
- Convenient way to buy and apply a small amount of pesticide.  
- Retain potency for some time. | - Practical for only a few limited or specialized uses.  
- Risk of inhalation exposure.  
- Hazardous if punctured, over-heated, or used near an open flame.  
- May be difficult to direct material released to a single target site or pest. |
| Dusts (D) | - Ready-to-use and contain a low percentage of active ingredient.  
- Have one or more active ingredients plus a very fine, dry inert carrier made from talc, chalk, clay, nut hulls, or volcanic ash.  
- Not water-soluble. | - Usually ready-to-use; no mixing.  
- A good alternative where moisture from a spray might cause damage.  
- Applied with simple application equipment.  
- Effective in hard-to-reach indoor areas. | - Easily drift off target during application.  
- Residues do not adhere to treated surfaces, including foliage, as well as liquids do; may easily wash off or blow away.  
- May irritate eyes, nose, throat, and skin; pose a relatively high inhalation exposure risk to handlers.  
- Dampness may cause product to clump and equipment to clog; difficult to apply in damp or humid environments.  
- Some kinds of application equipment and devices are hard to calibrate.  
- It can be difficult to get an even distribution of particles. |

**DRY FORMULATIONS** (Ready-to-use and Concentrates)

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- Dampness may cause product to clump and equipment to clog; difficult to apply in damp or humid environments.  
- Some kinds of application equipment and devices are hard to calibrate.  
- It can be difficult to get an even distribution of particles. |
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<tr>
<td>Granules (G)</td>
<td>• Easily drift off target during application.</td>
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<td>• Application equipment needs frequent calibration.</td>
</tr>
<tr>
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<td>• Residues do not adhere to treated surfaces, including foliage, as well as liquids do; may easily wash off or blow away.</td>
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<td>• Application equipment is not as convenient to calibrate as spray equipment. Released particles are measured by weight instead of by volume.</td>
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<td>• May irritate eyes, nose, throat, and skin; pose a relatively high inhalation exposure risk to handlers.</td>
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<td>• Uniform application may be difficult with some devices (e.g., rotary spreaders).</td>
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<td>• Dampness may cause product to clump and equipment to clog; difficult to apply in damp or humid environments.</td>
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<td>• Granules do not stick to foliage or other uneven surfaces.</td>
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<td>• Some kinds of application equipment and devices are hard to calibrate.</td>
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<td>• May need to be incorporated into soil or planting medium.</td>
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<td>• It can be difficult to get an even distribution of particles.</td>
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<td>• May need moisture to release the active ingredient; may not be effective in drought conditions.</td>
</tr>
<tr>
<td>Pellets (P or PS)</td>
<td>• All particles are more or less the same weight and shape.</td>
<td>• Easy to store, transport, and handle.</td>
<td>• May be hazardous to nontarget species, especially waterfowl and other birds.</td>
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<td>• Often used to bait rodent burrows.</td>
<td>• Less likely than ECs and other petroleum-based formulations to harm treated plants, animals, and surfaces.</td>
<td>• Bulky; low percentage of active ingredient per unit volume.</td>
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<tr>
<td>Wettable Powders (WP or W)</td>
<td>• Dry, finely ground solid materials.</td>
<td>• Easy to store, transport, and handle.</td>
<td>• Not easy to measure; must be weighed.</td>
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<td></td>
<td>• Most include wetting and/or dispersing agents.</td>
<td>• Less likely than ECs and other petroleum-based formulations to harm treated plants, animals, and surfaces.</td>
<td>• Not easy to mix.</td>
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<tr>
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<td>• Must be mixed with water and applied as a spray.</td>
<td>• As a rule, not phytotoxic.</td>
<td>• Inhalation hazard to applicator while measuring and mixing the concentrated powder.</td>
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<td>• Contain 5% to 95% active ingredient—usually 50% or more.</td>
<td>• Less risk of skin and eye absorption than ECs and other liquid formulations.</td>
<td>• Suspended particles require good and constant agitation (usually mechanical) in the spray tank and quickly settle out if agitation ceases.</td>
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<td>• Do not dissolve in water. When mixed with water, they form a suspension.</td>
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<td>• Abrasive to pumps and nozzles; causes equipment wear.</td>
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<tr>
<td>Wettable Powders, Con’t.</td>
<td>• Will settle out quickly without constant agitation to keep them suspended.</td>
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<td>• Difficult to mix in very hard or alkaline water.</td>
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<td>• If not mixed properly, may clog nozzles and screens.</td>
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<td>• Residues may be visible on treated surfaces.</td>
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<td>Water-Dispersible Granules (WDG)</td>
<td>• Wetable powder formulations compressed into dust-free, granule-sized particles.</td>
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<td>• Mixed with water and applied as a spray suspension.</td>
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<td>• Once in water, the granules break apart into fine powder.</td>
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<td>• Requires constant agitation to keep it suspended in water.</td>
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<tr>
<td>Soluble Powders (SP or WSP)</td>
<td>• Dissolve readily in water and form a true solution.</td>
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<td>• After a thorough mixing, no additional agitation is necessary.</td>
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<td>• Amount of active ingredient in soluble powders ranges from 15% to 95%; it usually is more than 50%.</td>
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<td>Baits (B)</td>
<td>• An active ingredient mixed with food or another attractive substance.</td>
<td>• Ready-to-use.</td>
<td>• May be attractive to children and pets.</td>
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<td>• The amount of active ingredient in most bait formulations is quite low, usually less than 5%.</td>
<td>• Entire area need not be covered because pests go to bait.</td>
<td>• May kill domestic animals and nontarget wildlife.</td>
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<td>• Can be liquid or solid.</td>
<td>• Control pests that move in and out of an area.</td>
<td>• Require careful placement and inspection.</td>
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<td>• Pest may prefer other food to the bait.</td>
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<td>• Dead vertebrate pests may cause odor problems.</td>
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<td>• If baits are not removed after the pesticide stops working, they may serve as a food supply for the target pest or other pests.</td>
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<td>• May not work in situations where pests have many other food or water sources.</td>
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## OTHER FORMULATIONS

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| Fumigants                         | • Fumigants are pesticides that deliver the active ingredient to the target site in the form of a gas. | • Toxic to a wide range of pests.  
• Can penetrate cracks, crevices, wood, and tightly packed areas.  
• A single treatment will usually kill most pests in the treated space. | • The target site must be enclosed or covered to prevent the gas from escaping.  
• Nonspecific and highly toxic to humans and all other organisms.  
• High inhalation exposure risk.  
• Most require the use of specialized personal protective equipment.  
• May require the use of specialized application equipment.  
• Some have specific temperature requirements. |
| Microencapsulated Pesticides (M)  | • Dry particles or liquid droplets surrounded by a coating.  
• Mixed with water and applied as a spray. Once applied, the pesticide is released from the capsule.  
• Encapsulation process can provide “timed” slow release of the active ingredient. | • Coatings help protect the applicator.  
• Easy to mix, handle, and apply.  
• Timed release of active ingredient prolongs effectiveness.  
• Reduced volatility.  
• Reduced odor.  
• Less likely to stain or otherwise damage treated surfaces.  
• Reduced phytotoxicity. | • Constant agitation may be necessary in spray tank.  
• Risk of injuring or killing bees.  
• Long restricted-entry or pre-harvest intervals for highly toxic products. |
| Water-Soluble Packaging (WSB or WSP) | • When added to water in a spray tank, the bag dissolves and releases the contents, which then are suspended or dissolved.  
• Reduces handler exposure risk.  
• Simplifies measuring. | • Accurate premeasured unit doses.  
• Increased handler safety; greatly reduced exposure risk.  
• Lower risk of spills. | • Package size may not match volume of prepared solution needed and/or spray tank volume.  
• May not be suitable for products applied in pounds or gallons of active ingredient per acre, due to the size or number of packets required.  
• Must be kept dry—away from water or high humidity—until ready to use. |