

Understanding Pesticide Formulations in Urban Pest Management

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LIQUIDS			
FORMULATION	DESCRIPTION	ADVANTAGES	DISADVANTAGES
Emulsifiable Concentrates (EC)	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • 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.

FORMULATION	DESCRIPTION	ADVANTAGES	DISADVANTAGES
Solutions (S)	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • Not all pests will feed on liquid baits. • You must refill or replace liquid-containing bait stations frequently.
Ultra Low Volume (ULV)	<ul style="list-style-type: none"> • 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). 	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • Easy to handle and apply; low exposure risk. • Generally, not phytotoxic. • Seldom clog nozzles. • Splashes are less likely than with other liquid formulations. 	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • Contain one or more active ingredients and a solvent. • Most contain a low percentage of active ingredient. • Two types: <ul style="list-style-type: none"> ○ ready-to-use ○ fog generators 	<ul style="list-style-type: none"> • Easy to use; convenient. • Portable. • Easily stored. • Convenient way to buy and apply a small amount of pesticide. • Retain potency for some time. 	<ul style="list-style-type: none"> • 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.
DRY FORMULATIONS (Ready-to-use and Concentrates)			
Dusts (D)	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • 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.

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Granules (G)	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • Application equipment needs frequent calibration. • Application equipment is not as convenient to calibrate as spray equipment. Released particles are measured by weight instead of by volume. • Uniform application may be difficult with some devices (e.g., rotary spreaders). • Granules do not stick to foliage or other uneven surfaces. • May need to be incorporated into soil or planting medium. • May need moisture to release the active ingredient; may not be effective in drought conditions. • May be hazardous to nontarget species, especially waterfowl and other birds. • Bulky; low percentage of active ingredient per unit volume.
Pellets (P or PS)	<ul style="list-style-type: none"> • All particles are more or less the same weight and shape. • Often used to bait rodent burrows. 		
Wettable Powders (WP or W)	<ul style="list-style-type: none"> • Dry, finely ground solid materials. • Most include wetting and/or dispersing agents. • Must be mixed with water and applied as a spray. • Contain 5% to 95% active ingredient—usually 50% or more. • Do not dissolve in water. When mixed with water, they form a suspension. 	<ul style="list-style-type: none"> • Easy to store, transport, and handle. • Less likely than ECs and other petroleum-based formulations to harm treated plants, animals, and surfaces. • As a rule, not phytotoxic. • Less risk of skin and eye absorption than ECs and other liquid formulations. 	<ul style="list-style-type: none"> • Not easy to measure; must be weighed. • Not easy to mix. • Inhalation hazard to applicator while measuring and mixing the concentrated powder. • Suspended particles require good and constant agitation (usually mechanical) in the spray tank and quickly settle out if agitation ceases. • Abrasive to pumps and nozzles; causes equipment wear.

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Wettable Powders, Con't.	<ul style="list-style-type: none"> • Will settle out quickly without constant agitation to keep them suspended. 		<ul style="list-style-type: none"> • Difficult to mix in very hard or alkaline water. • If not mixed properly, may clog nozzles and screens. • Residues may be visible on treated surfaces.
Water-Dispersible Granules (WDG)	<ul style="list-style-type: none"> • Wettable powder formulations compressed into dust-free, granule-sized particles. • Mixed with water and applied as a spray suspension. • Once in water, the granules break apart into fine powder. • Requires constant agitation to keep it suspended in water. 		
Soluble Powders (SP or WSP)	<ul style="list-style-type: none"> • Dissolve readily in water and form a true solution. • After a thorough mixing, no additional agitation is necessary. • Amount of active ingredient in soluble powders ranges from 15% to 95%; it usually is more than 50%. 		
Baits (B)	<ul style="list-style-type: none"> • An active ingredient mixed with food or another attractive substance. • The amount of active ingredient in most bait formulations is quite low, usually less than 5%. • Can be liquid or solid. 	<ul style="list-style-type: none"> • Ready-to-use. • Entire area need not be covered because pests go to bait. • Control pests that move in and out of an area. 	<ul style="list-style-type: none"> • May be attractive to children and pets. • May kill domestic animals and nontarget wildlife. • Require careful placement and inspection. • Pest may prefer other food to the bait. • Dead vertebrate pests may cause odor problems. • If baits are not removed after the pesticide stops working, they may serve as a food supply for the target pest or other pests. • May not work in situations where pests have many other food or water sources.

OTHER FORMULATIONS

FORMULATION	DESCRIPTION	ADVANTAGES	DISADVANTAGES
Fumigants	<ul style="list-style-type: none"> • Fumigants are pesticides that deliver the active ingredient to the target site in the form of a gas. 	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • Accurate premeasured unit doses. • Increased handler safety; greatly reduced exposure risk. • Lower risk of spills. 	<ul style="list-style-type: none"> • 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.