

Pesticide Use Problems (Ornamentals)

Before developing a pesticide management system, a commercial pesticide applicator must consider possible side effects on their own body, on other employees and on clients. Possible side effects include drift damage, phytotoxicity, reentry, residues and tolerances. Personal health and the prosperity of the business depend on knowledge and care in application.

The manual, *A Guide for Private and Commercial Applicators: Applying Pesticides Correctly*, addresses the acute hazards to man and other warm-blooded animals that are associated with the handling of pesticides.

Hazards to Applicator, Worker and Consumer

Dermal Toxicity

The greatest hazard from pesticides is absorption of pesticides through the skin. A survey conducted in a leading agricultural state found that more than 80 percent of the cases of poisoning in agricultural and industrial settings resulted from pesticides being absorbed through the skin. This can be caused by a splash, spill or drift when mixing or applying the chemical or from contact with a pesticide residue after application.

The hazards associated with skin absorption are increased by cuts, abrasions, scratches, scuffs or other damage to the skin. However, absorption can occur rapidly even through healthy skin. Absorption is high and rapid through the scrotum, armpit, ear canal, forehead and scalp. It is slower in the palm of the hand and the ball of the foot. However, even in these lower absorption areas, penetration can be great and will vary from pesticide to pesticide. For example, carbaryl (Sevin) is thought of as a relatively safe material, but it is absorbed through the skin of the forearm about seven times more rapidly than malathion or parathion. Studies show pesticides can be absorbed within a few minutes; therefore, waiting until the job is done to wash spills or splashes on the skin may be too late. Wash by rubbing hands together alone or with a piece of cloth, using detergent or soap. Do not scrub with a brush, since the outer, protective layer of skin could be scratched enough to permit more rapid absorption of any pesticide that is not removed.

Since dermal toxicity is a major concern, the EPA has specified that shoes and socks, a long-sleeved shirt and long-legged pants are the minimum personal protective equipment (PPE) required for any pesticide application.

Eyes

Eyes are particularly sensitive to harm by pesticides and should be protected with goggles or a face shield. If a pesticide is splashed into the eye, immediately flush the eye with a gentle stream of clean, running water or eye flushing solution for 15 minutes while holding the eyelid open. A few seconds delay could increase the extent of the injury. Do not use chemicals or drugs in the wash water. They may increase the injury. Convenient plastic eye wash bottles and holders are available. These useful bottles can be purchased from chemical laboratory suppliers and are called "eye wash stations." Whether clean water or commercial solutions are used, these need to be changed periodically to ensure their safety and freshness.

Lungs

Many applicators are not aware that inhalation of pesticides is a serious hazard. Inhalation is next in importance to skin contact in toxicity concerns. Since the lungs have such a large and highly absorptive surface area, even small amounts of a pesticide are hazardous because they are almost completely absorbed in the lungs. Vapors and extremely fine particles, 10 microns or smaller, are particularly hazardous. Spray particles of this size can move deep into the lungs and reach the area of the lungs where the blood vessels take in oxygen. This is an extremely critical area for absorption of materials into the blood stream.

Respirators should be worn when required by the label and when the applicator deems it necessary (regardless of label requirements), such as when small spray particles may be present. Occasional use of moderately toxic pesticides that do not require a respirator may not pose a risk. However, daily use of such pesticides could greatly increase exposure and may require use of a respirator to decrease the risk (exposure).

Feet

Foot protection is an important safety tool when using pesticides for controlling ornamental pests. During the mixing/loading, application and sprayer cleaning processes, the feet are potentially exposed to pesticide concentrate and spray mixture. By wearing chemical-resistant footwear, potential contamination to the feet can be avoided.

When selecting boots for PPE, there are several items to consider. First, check to see that the soles of the footwear are made of a durable substance that will not wear out quickly on rough surfaces such as concrete, asphalt or gravel. Next, make sure the soles have skid-resistant surfaces. Some footwear is extremely slippery when used on smooth concrete or metal surfaces that are wet. Be sure the footwear can withstand the use to which they will be subjected. Also, consider the comfort of the wearer. For example, footwear that is excessively hot will not be worn by applicators. Lastly, consider the ease of putting on and removing the footwear. Remember, boots are not needed when driving between jobs or during most of the day; rather, they are needed only when exposure to pesticides may occur. Therefore, the footwear must be easily put on and removed. Otherwise, they will not be used at all.

Hands

If pesticide applicators could choose only one PPE item, it would likely be gloves.

When selecting gloves, remember that they come in different sizes and not all hands are the same size. Therefore, it is likely you will need different sizes of gloves for your business.

Make sure the gloves will not interfere with other operations that must be done when worn. If this occurs, accidents are likely to follow. Dexterity is very important when selecting gloves. If dexterity is not considered, it is likely the glove selected will not perform as desired and will not be used. Also consider the durability of the gloves. If reel hoses are being used, for example, the gloves must withstand the friction from the hose. Chemicals can easily penetrate gloves if small holes are worn in them.

When many types of pesticides are being used, experiment to see how the gloves will react with the various pesticides. Switch to another type of glove material if the gloves are observed to “bubble” or “blister,” because this is a chemical reaction and the glove material is being broken down.

Do not use latex gloves. Latex gloves will not provide the required protection. Use nitrile, butylene or a similar type of glove material. Do not use cloth or leather gloves for PPE. These gloves will absorb the pesticide and they cannot be cleaned. Only use these gloves as an outer glove with PPE underneath the cloth or leather gloves. When this is done, the cloth/leather gloves must not be used for other purposes, or they should be destroyed after each job.

Liners or gloves with liners are generally more comfortable to use and easier to remove. However, if the liner becomes contaminated with the pesticide, the hand becomes contaminated. Therefore, liners should only be used when one can ensure the liner will not become contaminated with the pesticide.

When repairing spray equipment, wear chemical-resistant gloves if the equipment has not been thoroughly washed.

Selection of Pesticide Protective Clothing

Selection can begin once you decide which pesticide to use and know how it affects humans. Without this information, selection is almost impossible. Once the pesticide has been selected, the label and Material Safety Data Sheet (MSDS) are to be consulted for toxicity and PPE information.

Personal Protective Equipment (PPE) Clothing

Minimum PPE clothing includes shoes and socks, long-legged pants and a long-sleeved shirt. These items are for all pesticide handling and application activities.

PPE comes in various forms and has different degrees of protection. The simplest is “normal” work clothing. Clothing should be of a closely woven fabric. The close weave “catches” more pesticide particles in the fabric, thus keeping them from directly contacting the skin. Generally, natural fabrics catch pesticide droplets better than synthetic fabrics. However, natural fabrics may be more difficult to clean. Natural fabrics are better at catching pesticide particles because the fibers are frayed. Multiple washings of synthetic fabrics before use will often fray the fibers, thus providing similar “catching” properties of natural fabrics. Synthetic fabrics are often somewhat water repellent which also increases their effective-

ness. However, normal work clothing should be worn only when the pesticide label permits them and when small amounts of spray particles are expected to be deposited on the clothing by those pesticides. Other PPE clothing should be used if one expects to receive large amounts of spray particles on their clothing.

PPE Material

Disposable PPE clothing is either woven or spun. Woven material is made of closely woven synthetic fibers. These materials are water-repellent and tightly woven, thus they greatly limit the amount of spray that reaches the body. Woven fabrics “breathe” and are relatively comfortable. These fabrics are often treated with water-repellent materials. The water-repellent materials increase protection, but they also decrease the fabric’s ability to breathe, making the clothing hotter and less comfortable. The other type of synthetic PPE is spun material. The fabric is extruded and does not have a weave. Since it lacks the “holes” woven materials contain, it is more protective because spray particles are much less likely to reach the skin. Spun materials are more repellent and hotter due to the decreased breathing of the fabric. There are newer fabrics with improved breathability. Treating spun materials with repellent materials will also increase its protecting ability, but it will decrease the materials breathability.

PPE Construction

It is important to know how PPE is constructed and the strong and weak points at critical areas of protective equipment.

Fabric

The choice of woven or spun fabric will partially depend on the pesticide applied. The other major consideration is comfort, which includes movement and breathability. If one is working in hot or warm conditions, the fabric’s ability to breathe can become as important as the chemical protection provided. A woven fabric that has been treated with a repellent may breathe better than a spun fabric. The choice of fabrics will depend on the individual’s circumstances and may have to be determined by trial and error.

Seams

Check the garment’s seams. There are three types of seams. The simplest is a stitched seam. These can be effective or not, depending on the

protection needed and strength of the seam. Stitching should be close (tight). Tight stitches help decrease the chance of spray particles passing through the seams. Double stitching is better than single because it adds protection and strength.

Fused seams are created by fusing or welding the fabric pieces together. A fused seam provides greater protection than a stitched seam, but its decreased breathing could create a comfort concern. Most fused seams are of sufficient strength, but they should be inspected before purchasing to ensure integrity.

The third type of seam is a combination of sewn and fused. This type of seam is the most protective because it provides all the benefits of the two; however, the breathability will be decreased.

Zippers, Buttons, Velcro, Drawstrings and Snaps

The fastening device can be very important. Buttons provide the least protection, because spray particles can pass through or around the loose closure. Velcro can provide a tighter closure; however, spray particles can build up on the velcro. Drawstrings on pants can create the tight fit needed but, like velcro, they can become contaminated over time. Metal zippers can become corroded by pesticide sprays. Plastic zippers can be dissolved if concentrated formulations are spilled on them. Zippers can form a tight or loose closure. Obviously, a tight closure is desired. One should consider the ease of operating the zipper with gloves. Snaps are similar to zippers and buttons. They have the same problems as buttons but are generally easier to fasten. Like zippers, they can be damaged by certain types of pesticide formulations. Snaps can also be damaged by being bent, thus they can be difficult to fasten. Often, closure devices can be improved by being inset with a covering flap.

How to Select PPE Clothing

First, determine the major formulations and requirements on the pesticide label and its MSDS. Regardless of whether woven or spun material is selected, be aware of a number of items pertaining to the construction of the PPE.

Once the type of PPE is known, the applicator must take into account the various aspects of the PPE to be worn. If heat is a concern, PPE which does not “breathe” may need to be avoided and another type used.

In selecting PPE, consideration of applicator requirements is paramount. PPE must not bind or restrict the applicator's movement such that the PPE becomes a greater hazard than the pesticide. Most PPE coveralls and sleeve protectors are bulky. When working around moving parts, such as reel hoses and sprayer pulleys, care must be taken to ensure clothing does not get caught in moving equipment.

Cleaning and Disposing of PPE

Boots and gloves should be washed with soap and water before removal. Disposable coveralls that received an excessive amount of spray residue should be rinsed with clean water before removal. These actions provide safety measures for the wearer during the changing and storage process of the PPE.

Once removed, gloves should be washed again in soap and clean water and air-dried in a location away from pesticides. Cloth coveralls should be washed, if possible, and air-dried. When washing, use 140°F water, a full wash load cycle and a strong detergent. Wash the clothes in a load by themselves – do not wash PPE with other laundry. This helps avoid possible cross contamination of pesticide residues with other clothing. Air-dry the clothes. Run another complete cycle through the washer to clean the washer drum. Disposable coveralls may be laundered according to the manufacturer's instructions. An applicator has to make the decision whether to launder disposable coveralls or to use them a specified number of times and then destroy them. When disposable coveralls are laundered, they lose some of their protecting ability. Any PPE that is exposed to concentrate pesticides should be rinsed and disposed.

Respirators are to be washed and dried after each day's use. They may be washed in warm water with mild soap, wiped and hung up to air-dry. Do not use alcohol on respirators. Likewise, eye protection needs to be washed in the same manner after each day's use.

When PPE items are to be disposed of, shred and destroy them after cleaning so someone else cannot use them.

Cost of PPE

PPE costs do vary. The type and cost of PPE should be included in the selection of a pesticide.

Regulatory Matters

Reentry Into Treated Areas

Reentry requirements have been established for ornamental pesticides applications, as has been done for many agricultural pesticides. Ornamental pesticide labels do address reentry, usually by stating, "...Keep children and pets off treated areas until the sprays have dried." Some labels may provide a safe time for reentry, such as 12 or 24 hours after treatment. Such label statements are to be followed. They also must be considered when selecting a pesticide. Such requirements for pesticides to be used in parks and other high traffic areas can cause extreme management problems for the applicator.

Endangered Species Act

The Endangered Species Act (ESA) affects all federal programs and agencies. Since the EPA registers pesticides, pesticides are covered under the ESA. The act applies to all outdoor applications of pesticides.

Basically, no person is to take any action that may harm or kill a federally endangered or threatened species. This includes affecting the species habitat or food source. Ornamental pesticide applicators are responsible for determining whether or not their actions will harm an endangered species in the area to be treated. Your county Cooperative Extension educator, Extension pesticide coordinator, U.S. Fish and Wildlife Service representative and Arkansas State Plant Board inspector can provide information on location of endangered or threatened species.

Pesticides and Water

Arkansas has numerous lakes that provide drinking water. However, most of the fresh water in the United States is ground water. Rural residents and small communities usually receive drinking water from ground water sources. Pollution affects about 2 percent of ground water in the U.S. Unfortunately, an increasing amount of surface water is also becoming contaminated (EPA 1990).

Agriculture accounts for two-thirds of the more than 4.5 billion pounds of pesticides used in the U.S. yearly. This figure includes pesticides used in ornamental and turf and greenhouse production systems. The home and garden sector used 135 million pounds of pesticides in 1995 (EPA 1997).

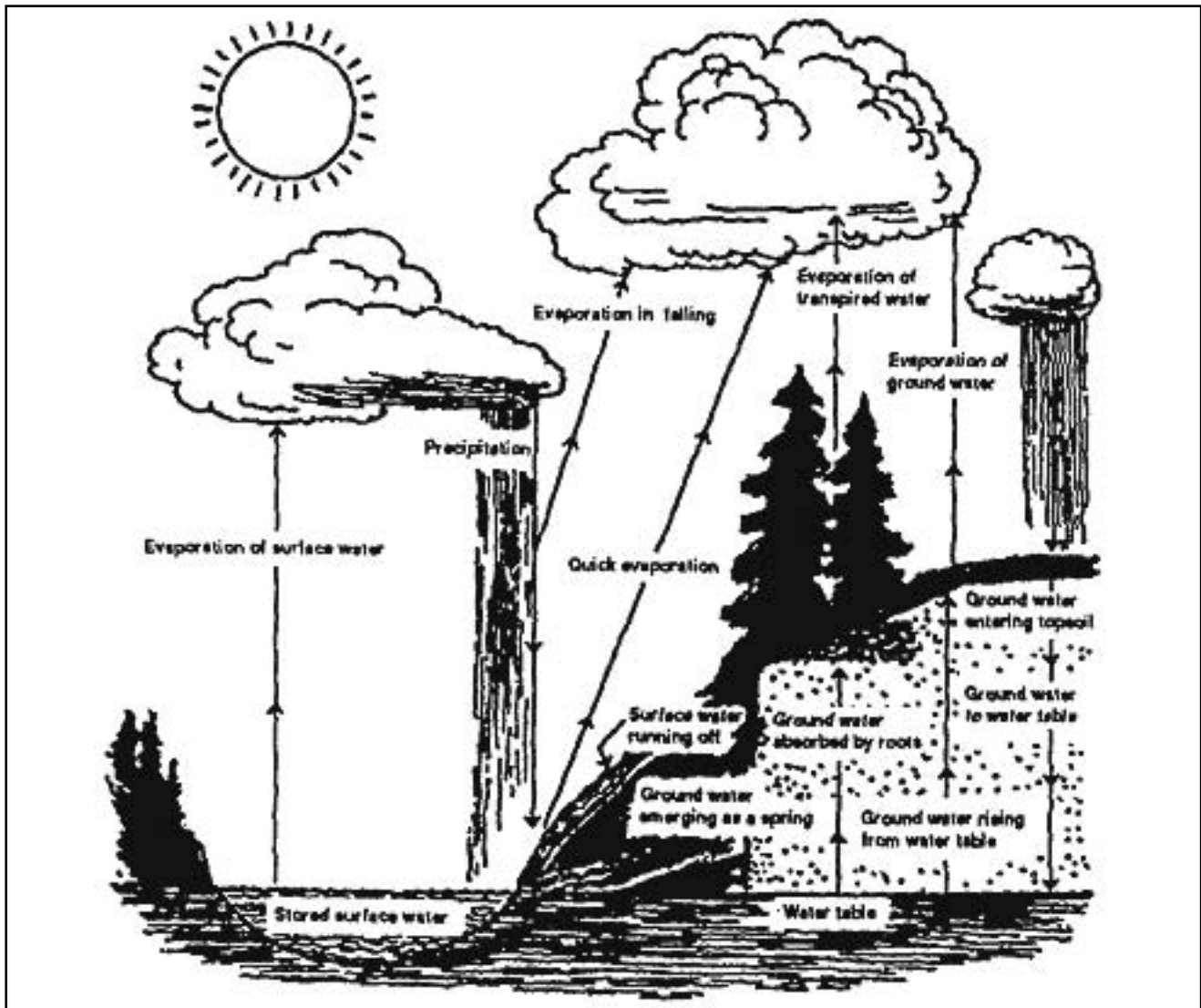


Figure 1.8.1. The hydrologic cycle.

Pesticides can contaminate water throughout the hydrologic cycle (Figure 1.8.1). Water contamination is directly related to the degree of pollution in our environment. Rainwater flushes airborne pollution from the skies. Pollution is then washed over the land before running into rivers and lakes and seeping into underground aquifers. Since irrigation and drinking water come from surface and ground water, any chemical used may pollute our water supplies (Figure 1.8.2).

While some substances that endanger water quality come from agriculture, most result from urban and industrial activity. Some also come from pesticide use on ornamentals. Whether in agricultural operations or in urban environments, the improper application, handling or disposal of pesticides can lead to water pollution. Therefore, it is important

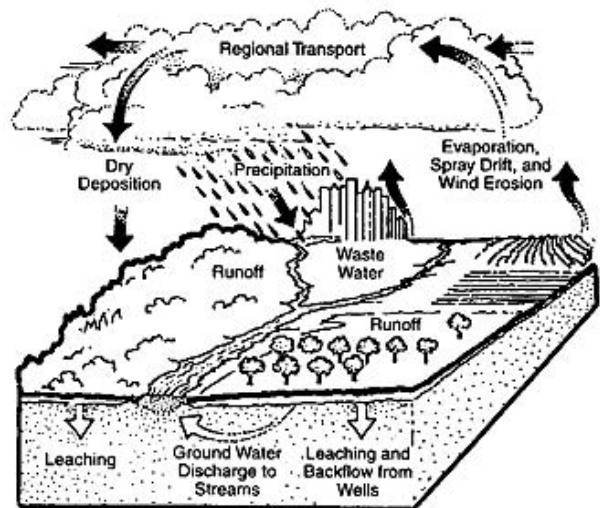


Figure 1.8.2. Pathways of pesticide movement in the hydrologic cycle.

for ornamental operators to understand how to properly use pesticides to avoid human exposure and to protect water sources.

When selecting pesticides for use in ornamental settings, choose pesticides that will control the pest and have the least ability to runoff or leach into the soil. To achieve this balance, the applicator must be knowledgeable of a pesticide's efficacy and water solubility. Unfortunately, it is often difficult to determine if a pesticide has the potential to leach or run off into water sources. Water solubility information is available on the pesticide's label and the Material Safety Data Sheet (MSDS). However, many MSDS's do not provide water solubility or K_{oc} information. For specific product information, check reference sources and the company's technical sheets. Additional water data is often available from the University of Arkansas, Division of Agriculture, and the chemical company. **It is important to build your own file on pesticides and their potential for water contamination.**

Determining the soil type can be tricky for ornamental planting. Consider whether the planting is on natural soil in a relatively undisturbed area or on soil that was "developed" or "made." To assist with planting, contact the USDA – Natural Resources Conservation Service (NRCS) for soil maps to determine soil type, texture, organic matter content and depth to ground water. However, if the area experienced major soil movement and alteration, NRCS soil maps may not be useful.

Areas that are designed to drain require special consideration when selecting the appropriate pesticide. Determine if the planting has drain tiles or other drainage systems installed and know where these drainage systems empty. It is not good to move contaminated water from a treated area into any water system.

Determine the irrigation system to be used for the planting. During the planning process, consider the timing of pesticide application and the irrigation schedule. Pesticides should not be washed off the plants or through the soil too quickly.

Be prepared for accidents. Hoses sometimes break, drain plugs come out and sprayers can accidentally be overturned. Have the appropriate spill containment equipment in your vehicle.

Keep in mind that even if all the "numbers" indicate a pesticide has a high potential to

leach or run off, this does not mean the pesticide will actually reach the water. There are many factors and situations that affect the risk of contamination.

Ways Pesticides Can Contaminate Water

Overapplication or misuse of pesticides can allow these materials to enter the surface and/or ground water. For some of the newer pesticides, drift from soil particles treated with the pesticide is a potential source of water contamination. Newer pesticides are often active at very low concentrations and, when bound to soil particles, the pesticide may be picked up by the wind and moved over surface water. When deposited in water, the soil particle with the pesticide attached can then move into the surface water. This is generally not a major problem unless large amounts of contaminated soil particles are moved and deposited in the same area or unless the pesticide is active on other target species.

Improperly cleaning pesticide containers and sprayers often leads to pesticide runoff or contamination of the soil at the mixing/loading site. Pesticide sprayers should be loaded and cleaned on an impervious pad. This eliminates concern about spills causing runoff or leaching problems, avoiding potential contamination of wells from constant small spillages at the same site.

When filling any sprayer, either an anti-back-siphoning device or an air gap should be used. This prevents the back siphoning of the pesticide mix into the water line if water pressure is lost. If using anti-back-siphoning devices, periodically inspect the device to ensure it is functioning correctly. Mechanical back-siphoning devices have been known to stick in the open position.

Pesticide containers should be pressure or triple rinsed immediately after emptying to rinse all the excess pesticide from the container. The rinsate is to be rinsed directly into the sprayer so the rinsate can be sprayed on the labeled site. This provides a clean container that can be recycled.

Pesticide Properties

It is extremely important to know the properties of the pesticide before its purchase and use. Know the pesticide's formulation,

persistence, volatility, solubility in water and its soil adsorption.

Formulation – Pesticides come in several physical formulations. Common formulations include emulsifiable and flowable concentrates, wettable powders, granules and water dispersible granules.

Persistence – Persistence describes how long a pesticide remains active. Half-life is one measure of persistence. The half-life of a substance is the time required for that substance to degrade to one-half its original concentration. In other words, if a pesticide has a half-life of 10 days, half of the pesticide is broken down or lost 10 days after application. After this time, the pesticide continues to break down at the same rate.

The half-life of a pesticide is not an absolute factor. Soil moisture, temperature, organic matter, microbial activity, soil pH and sunlight all affect the breakdown of pesticides. In general, the longer a pesticide persists in the environment, the more likely it is to move from one place to another and be a potential water contaminant.

Volatility – Many pesticides, including several herbicides and soil fumigants, can escape from soils as gases. Some can distill from soils and enter the atmosphere with evaporating water. Pesticide particles in the atmosphere can come back to earth in rain or snow, which can leach into ground water or be carried by runoff into surface water.

Water Solubility – The water solubility of a pesticide determines how easily it goes into solution with water. When a pesticide goes into solution with water, the pesticide will move where the water goes. Solubilities are usually given in parts per million (ppm) or, in some cases, as milligrams per liter (mg/l). The solubility of a substance is the maximum number of milligrams that will dissolve in 1 liter of water.

Simply being water-soluble does not mean that a pesticide will leach into ground water or run off into surface water. However, solubility does mean that if a soluble pesticide somehow gets into water, it will probably stay there and go where the water goes.

Water solubility is one indicator of the pesticide's mobility in water. For most

compounds, water solubility and adsorption to soil particles are inversely related. However, as with most rules, there are exceptions. Water solubility greater than 30 ppm indicates that significant mobility is possible if the K_{oc} value is low (less than 300-500). Pesticides with solubility greater than 30 ppm and K_{oc} values less than 100 are considered to be a concern in sandy soil, according to the EPA.

Pesticides with solubilities of 1 ppm or less are believed to have a higher likelihood of runoff. Likewise, pesticides with high K_{oc} values are more likely to run off than leach. Pesticides with K_{oc} values of 1,000 or higher have a strong soil attachment.

Soil Adsorption – Soil adsorption is the tendency of materials to attach to the surfaces of soil particles. If a substance is adsorbed by the soil, the substance stays on or in the soil and is less likely to move into the water system unless soil erosion occurs. A soil's texture, structure and organic matter content affect the soil's ability to adsorb chemicals.

The K_{oc} describes the relative affinity or attraction of the pesticide to soil material and, therefore, the pesticide's mobility in soil. Pesticides with small K_{oc} values are more likely to leach than those that have high K_{oc} values.

How Pesticides Enter Surface and Ground Water

Pesticides can enter water through surface runoff, leaching and erosion. Water that flows across the surface of a planting, whether from rainfall, irrigation or other sources, always flows downhill until it meets a barrier, joins a body of water or begins to percolate into the soil.

Wind and water can erode soil that contains pesticide residues and carry them into nearby bodies of water. Even comparatively insoluble pesticides and pesticides with high soil adsorption properties can move with eroding soil. A number of the sulfonylurea herbicides have warning statements regarding movement of treated soil.

With increasing frequency, soil-applied pesticides are being found in ground water where the water table is close to the soil surface and/or where the soil is sandy. As a result,

ornamental applicators need to ensure that irrigation systems are not operated too long after pesticides have been applied. This will avoid the irrigation water washing the pesticide off the planting and into the storm drain.

Pesticides that enter water supplies can come either from point sources or from nonpoint sources. Pollution from point sources originates from small, easily identified causes or areas of high pesticide concentration, such as tanks, mixing/loading sites at wellheads, containers or spills. Nonpoint sources are diffuse, undefined areas in which pesticide residues are present, such as fields or city streets.

Water Quality Protection

Most pesticide contamination does not come from the normal, correct usage. Problems arise from misuse or careless handling. A checklist is provided to use when applying any pesticide. Use these guidelines to help safeguard water sources near your ornamental operation:

- Read and follow pesticide label directions.
- Consider the susceptibility of the site. Be sure that weather and irrigation will not increase the risk of water contamination.
- Evaluate the location of water sources, including storm drains.
- Use IPM practices.
- Make sure pesticide containers do not leak.
- When possible, use pesticides with the least potential for surface runoff and leaching.
- Prevent backflow during mixing operations by using a mechanical anti-back-siphoning device or an air gap.
- Always mix, handle and store pesticides down slope and at least 50 feet from water wells.
- Do not apply pesticides when conditions are most likely to promote runoff or excessive leaching.

- Do not spray pesticides on windy days (winds in excess of 10 mph).
- Calibrate all pesticide application equipment at least after every third use.
- Prevent pesticide spills and leaks from application equipment.
- Leave buffer zones around sensitive areas, such as wells, gardens, water gardens, streams, drainage ditches, septic tanks and other areas that lead to ground or surface water.
- Do not water pesticide-treated areas immediately after application unless indicated on label instructions.
- Triple or pressure rinse pesticide containers upon emptying and pour rinsate into the spray tank.
- Store pesticides properly.
- Dispose of excess pesticides by using on labeled sites.

Tables 1.8.1, 1.8.2 and 1.8.3 are provided at the end of this chapter to give examples of information needed for making decisions to avoid surface or ground water contamination. Ornamental applicators should develop a database for the pesticides they apply to ornamentals.

Worker Protection Standard

Although the EPA's Worker Protection Standard (WPS) does not include applicators treating household/urban ornamentals, it does include those making applications to greenhouse, nursery and Christmas tree sites. We would expect many of the requirements for WPS to eventually include ornamental applicators. In that respect, applicators should carefully read the pesticide labels for PPE requirements.

Table 1.8.1. Insecticide Water Quality Data.

Common Name	Solubility (ppm)	Toxicity (LD ₅₀) (rat) in mg/kg	Half-Life in Days	Persistence in the Soil	Soil Adsorption
Abamectin	.001	650	>30	Low	High
Acephate	650,000	1,447	3	Low	Medium
Bendiocarb	280	179	5	Low	
Carbofuran	351	4	40	Medium	Medium
Carbaryl	120	283	10		High
Chlorpyrifos	1.4	270	30		High
Cyfluthrin	.025	826	30	Low	
Diazinon	60	300	30		High
Dicofol	.8	595	60		Large
Dimethoate	23.3	235	7		Medium
Disulfoton	25		2	Medium	Medium
Endosulfan	.32	160	150	High	
Fluvalinate	.001	16,800	50		
Imidacloprid	610	5,000	<1	Low	Medium
Lindane	7.3	125		High	
Malathion	145	2,800	1		
Oxamyl	280,000	4	10	Medium	Low
Permethrin	.2	4,000	<40		
Propargite	632	119	56		

Table 1.8.2. Herbicide Water Quality Data.

Common Name	Solubility (ppm)	Toxicity (LD ₅₀) (rat) in mg/kg	Half-Life in Days	Persistence in the Soil	Soil Adsorption
Fluazifop-P-butyl		2,712	<21		
Glyphosate		5,000	60	Low	High
Metolachlor	530	2,780			High*
Napropamide	73	>500	25	Low	High
Oxadiazon	0.7	>5,000	>90		High
Oxyfluoren	0.1	>5,000	30		High
Oryzalin	2.6	>10,000	>30		
Oxadiazon	0.0007	4,100			High
Pendimethalin	0.275	3,956	>90	High	High
Sethoxydim	4.8	3,125	4-11	Low	Low
Simazine	3.5	>5,000	50		High*
Trifluralin	0.3	>10,000	>60	Medium	High

*Is readily absorbed by 2% or greater organic matter and clay soils.

Figure 1.8.3. Fungicide Water Quality Data.

Common Name	Solubility (ppm)	Toxicity (LD₅₀) (rat) in mg/kg	Half-Life in Days
Captan	3.3	9,000	3
Chlorothalonil	.81	>10,000	30
Copper	2.9	4,500	
Etridiazole	117	1,077	10
Fenarimol	13.7	3	360
Ferbam	130	>17,000	17
Fosetyl-Al	12,000	5,800	<1
Iprodione	13	>4,400	
Mancozeb	6.2	11,200	15
Metalaxyl	7,100	669	30
Myclobutanil	142	i,600	66
Propiconazole	100	1,517	100
Thiophanate-methyl		7,500	21
Triadimefon	64	1,000	26
Triflumizole	12,500	715	14
Triforine	9	>16,000	21
Vinclozolin	2.6	>5,000	20
Ziram	1.58	320	1