UMass Extension

CHECKLIST
PESTICIDES AND GROUNDWATER PROTECTION

- ✓ Extra precautions should be taken to protect ground water in areas where it is close to the soil surface.

- ✓ When using any pesticide product, follow label directions to minimize its environmental impact.

- ✓ Mixing areas should be over an impervious surface to prevent a spill from soaking into unprotected soil.

- ✓ Measure concentrated pesticides carefully and accurately.

- ✓ Never leave a tank while it is being filled.

- ✓ Calibrate spray equipment to use the right amount of product on the crop. Over application increases the risk of contaminating water.

- ✓ Maintain spray equipment. Check all nozzles for possible clogs. Clean equipment inside and out by triple rinsing and dispose of rinsate according to label instructions.

- ✓ Know where the wells are located and condition of the well. Know the depth to groundwater and where surface water and make plans for protecting them.

PESTICIDES AND GROUNDWATER PROTECTION

Many factors affect pesticide persistence and movement in soils. These factors should be considered when developing a pest management strategy, in order to protect both crops and our ground and surface water resources.

Most pesticides detected in ground water are those which are incorporated into the ground soil rather than those sprayed onto growing crops. Pesticides reach groundwater through runoff and leaching. Runoff carries pesticides over the ground in rain or irrigation water. Runoff is the movement of chemicals in water over a sloping surface. Runoff can carry pesticides mixed in water or bound to eroding soil. In addition, pesticides can move from the point of application by volatilization and plant uptake.

Leaching pesticides can move with the infiltrating water through the soil profile to the water table. The closer the water table is to the surface, the greater is the risk that it may become contaminated. In some situations, pesticides that are tightly bound to the soil may only move a few inches from the point of application regardless of the amount of infiltrating water, while in other situations pesticides have been shown to move many feet. Pesticides that are highly water soluble, relatively persistent, and not readily adsorbed by soil particles have the greatest potential for movement. In addition, relatively sandy soils that are low in organic matter are the most vulnerable to groundwater contamination due to their lower adsorptive capacity and higher infiltration rates.

There are several factors that determine the likelihood of a pesticide reaching surface or ground water: The properties of the pesticide, properties of the soil, conditions of the site and pesticide management practices.

Properties of Pesticides

Solubility

Some pesticides are more soluble in water than others. Highly soluble pesticides have a greater tendency to move by runoff or leaching from the point of application.

Degradation

Pesticide persistence is usually expressed in terms of half-life, which is the typical length of time needed for one-half of the total amount of chemical applied to break down to non-toxic substances. Sunlight, temperature, soil and water pH, microbial activity and other soil characteristics may affect the breakdown of pesticides. Microbial degradation is the breakdown of chemicals by microorganisms. Soil organic matter and soil properties such as moisture, temperature, aeration, and pH all affect microbial degradation. Weather is also an important factor, as it affects both the persistence and movement of pesticides. Rainfall and irrigation can move surface-applied pesticides into the soil. The longer a pesticide persists in the environment, the longer it is subject to movement deeper into the soil profile.

Adsorption

Adsorption is the binding of chemicals to soil particles. Pesticide adsorption varies with the properties of the chemical, as well as the soil's texture (relative proportions of sand, silt and

clay), moisture level and amount of organic matter. Soils high in organic matter or clay tend to be most adsorptive and sandy soils low in organic matter tend to be least adsorptive.

Volatility

Highly volatile chemicals are more likely lost to the atmosphere than to water supplies. However, highly volatile compounds may contaminate water if they are also highly soluble.

Properties of Soil

Soil Texture

The proportions of sand, silt and clay in the soil affect the movement of dissolved pesticides through soil. Soils with more clay and organic matter tend to hold water and dissolved chemicals longer. Pesticides have a greater chance of reaching ground water through coarse textured, sandy soil. Clay soils are more prone to rapid runoff – leading to surface water contamination.
Soil Permeability – The measure of how fast water can move downward through a particular soil is called soil permeability. High permeability soils lose dissolved chemicals with the percolating water.

Organic Matter

The content of organic matter in soil influences how much water a soil can hold, and how well it will be able to adsorb pesticides. Increasing the soil's organic content increases the soil's ability to hold water and dissolved pesticides in the root zone, to be available to plants and subject to eventual degradation.

Site Conditions

Site conditions should be considered to protect groundwater supplies.

Depth to Ground Water: The shallower the depth to ground water, the less soil there will be to impede the flow of contaminants and fewer opportunities for degradation or adsorption of pesticides. Growers should take extra precautions to protect ground water in areas where it is close to the soil surface.

Geologic Conditions: The permeability of the geologic layers between the soil and ground water such as gravel deposits, allow water and dissolved pesticides to percolate downward to ground water. Layers of clay are less permeable and inhibit the movement of water. Ground water quality is most vulnerable in areas where permeability of geologic layers is rapid.

Climate: High rates of rainfall or irrigation may result in large amounts of water percolating through the soil and are highly susceptible to pesticide leaching and contamination caused by runoff.

Handling Practices

When using any pesticide product, follow label directions. The label provides important instructions for obtaining the greatest benefit from the product and minimizing its environmental impact. Label directions include proper mixing and application, as well as pesticide storage and disposal.

More pesticide spills happen while measuring and mixing pesticides than in any other phase of application. Make sure mixing areas are over an impervious surface such as concrete to prevent a spill from soaking into unprotected soil. Measure the concentrate carefully and accurately. Never leave a tank while it is being filled. Overfilling the tank and spilling pesticide out on the ground can easily be prevented.

Calibrate spray equipment. Accurately calibrating application equipment is vital to spraying the right amount of product on the crop. Over application increases the risk of contaminating water. It may also overload the protective mechanisms of degradation, adsorption and result in water contamination.

Maintain spray equipment. Application equipment should be tested frequently to determine if it is working properly. A trial run with plain water helps to determine the spray pressure needed to cover a specific area at the labeled rate. Check all nozzles for possible clogs. After each use, clean equipment inside and out by triple rinsing and dispose of rinsate according to label instructions.

Knowledge of the site and application methods are helpful for preventing water contamination. Know where the wells are located and condition of the well. Know the depth to groundwater and where surface water is located. After identifying these factors, make plans for protecting them.

References

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