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14. Fate of Herbicides in Soil



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The fate of herbicides in soils pertains to their interaction with soil environment. Factors influencing persistence of herbicides are :

- Micro-Organism Decomposition
- Chemical Decomposition
- Photodecomposition
- Adsorption of Herbicide by the Soil
- Surface Runoff
- Leaching
- Plant Uptake
- Volatilization



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14.1 Micro-Organism Decomposition

The principal micro-organisms in the soil are algae, fungi, actinomyces, and bacteria. They must have food for energy and growth. Organic compounds of the soil provide this food supply, except for a very small group of organisms that feed on inorganic sources. Microbial degradation occurs when microorganisms such as fungi and bacteria use a herbicide as a food source.



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14.2 Chemical Decomposition

Chemical degradation is the breakdown of a herbicide by soil processes not involving a living organism. Adsorption of the herbicides, soil pH, soil temperature and moisture influence the rate of degradation. Some herbicides are more rapidly degraded on low pH soils. Chemical decomposition destroys herbicides through interaction with the soil constituents of oxygen, hydrogen or water. Hydrolysis (interaction with water), for example, is responsible for inactivating atrazine in the soil.



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14.3 Photodecomposition

Photodegradation is the breakdown of herbicides by the action of sunlight. Herbicides applied to foliage or the soil surface may be broken down by exposure to light. Soil incorporation can reduce herbicide exposure to sunlight. Ultraviolet light from the sun decomposes many herbicides applied to the soil surface. Some herbicides such as fluchloralin, trifluralin are recommended for soil incorporation as they break down readily when exposed to sunlight.



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14.4 Adsorption of Herbicide by the Soil

Herbicides tend to leave the soil solution and are adsorbed by clay and organic matter particles making the herbicide unavailable for uptake by the weed.

Research has shown that:

Soils high in organic matter require relatively large amounts of pre-emergence and soil sterilant herbicides for weed control.

Soils high in clay content require more herbicide than sandy soils for pre-emergence or soil sterilant weed control.

Soils high in organic matter and clay content tend to hold the herbicides for a longer time than sands.



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14.5 Surface Runoff

Runoff moves herbicides in surface water, either mixed in the water or bound to soil particles. The amount of herbicide runoff depends on the grade or slope of the field, the type of soil, the amount of rainfall (especially close to the time of application) and properties of the herbicide. For example, a herbicide applied to a saturated clay soil is highly susceptible to runoff.



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14.6 Leaching is the movement of herbicides through the soil into groundwater. Several factors influence leaching, including water solubility of the herbicide, soil structure and texture, and persistence of herbicide adsorption to soil particles. If a herbicide is strongly adsorbed to soil particles, it is less likely to leach, regardless of its solubility, unless the soil particles themselves move with the water flow. Leaching occurs in any direction (downward, upward, sideways).



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14.7 Plant Uptake

The uptake of herbicides by plant roots results in their removal from the environment; hence, reduced concentrations in the soil. Absorption is the process by which plants and microorganisms take up chemicals. Once absorbed, most herbicides are degraded within plants. Residues may persist inside the plant or be released back into the environment as the plant decays.



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14.8 Volatilization

Volatilization occurs when a solid or a liquid turns into a gas. A pesticide in a gaseous state can be carried away from the treated area by air currents. This is called vapor drift. Unlike the drift of sprays and dusts that can sometimes be seen during application, vapor drift is invisible. Avoid applying volatile herbicides when conditions favor volatilization, such as temperature inversions.