Behavior of herbicides in the soil

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Numerous factors influence the activation, efficacy, and residual properties of herbicides. Adsorption, leaching, and volatilization are physical processes that occur to herbicides within the soil. Adsorption can be beneficial by helping to retain herbicides within the surface layers of soil where it is needed for weed control and out of deeper layers where they might cause crop injury or enter ground water. If adsorption is very strong herbicide activity may be reduced, requiring higher application rates or causing a near complete loss of activity. If it is weak, herbicide activity may increase enough to cause crop injury. Leaching can aid in the distribution of the herbicide in the surface layers. However, if too much leaching occurs, the herbicide can injure the crop, be wasted, or enter ground water. Volatility can help distribute herbicides which do not move by other means within the surface layers of soil. It can also result in loss to the atmosphere and poor weed control.

Volatilization:

Vapor pressure is the pressure of the gas phase of a herbicide in equilibrium with the solid or liquid phase at any given temperature. Vapor pressure affects how volatile a herbicide is. Volatility is the tendency of a herbicide to escape as a gas. Typical vapor pressures for herbicides range from very volatile (3.4×10^{-2} for EPTC) to non-volatile (2.8×10^{-12} for Permit).

Leaching:

Leaching is the physical process of movement of herbicides in soil water flow. The amount of movement is influenced by amount of herbicide in the soil and the extent of water movement. The amount of herbicide in the soil solution is a function of the soluability of the herbicide and strength of soil binding (adsorption). Soluability is a measure of how much it ionizes in water. In most cases, as soluability declines, adsorption increases and soil mobility declines. Herbicides low in soluability are excluded from the soil water and become associated with soil colloids and organic matter. Soil sorption is a measure of the affinity of a herbicide to soil organic matter. Since organic matter is the most influential soil factor influencing adsorbtion, the KO_c of a herbicide is a very useful measure of its tendency to move with water in soil. The smaller the KO_c the more herbicide will be in solution and the greater the leaching potential. Soil mobility is influenced by several factors, including solubility and soil sorbtion. The higher the soluability and lower the KO_c value of a herbicide, the greater the tendency to be mobile in the soil.

Degredation:

Herbicide degredation is not a fixed property, but is influenced by soil and environmental conditions. Degredation, or the breakdown of herbicides can occur by microbial decompostion, chemical decomposition, photodecomposition, soil adsorption, volatilization, leaching, surface runoff, and plant metabolism. Half-life of a herbicide is the period of time required to result in a loss of half of the herbicide compound.

Selected References:

Ahrens, William H., ed. 1994. Herbicide handbook: weed science society of America seventh edition - 1994. Weed Science Society of America. Champaign, Illinois.

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Physical properties of selected preemergence and postemergence herbicides registered in tree and vine crops in California

Preemergence	Vapor Pressure (mm Hg)	Volatility	Sorbtion K_{oc} (mL/g)	Solubility (mg/L)	Soil Mobility	Half-Life (days)	Primary Degredation
Devrinol	4×10^{-6}	Low	73	700	Low	70	UV light
Gallery T&V	3.9×10^{-7}	Low	1	190-570	Low	50-120	UV light
Goal	2×10^{-6}	Low	.1	100,000	Low	35	UV light
Karmex	6.9×10^{-8}	Low	42	480	Med	90	Microbial
Kerb	8.5×10^{-5}	Med	15	800	Low-Med	60	Chemical
Princep	2.2×10^{-8}	Low	6.2	130	Low	91	UV light
Prowl	9.4×10^{-6}	Med	.275	17,200	Low	45	UV light
Solicam	2.9×10^{-8}	High	28	700	High	70-180	UV light
Surflan	$< 10^{-8}$	Low	2.6	600	Low	20	Microbial
Treflan	1.1×10^{-4}	Med	.3	7,000	Low	45	UV light
Visor	2×10^{-6}	Low	2.5	**	Low	64	Microbial
Postemergence							
Bueno 6	9.4×10^{-6}	Med	.275	17,200	45	Low	UV light
Diquat	$< 10^{-8}$	None	718,000	1,000,000	1000	None	UV light
Fusilade DX	2.5×10^{-7}	Low	1.1	5,700	15	Low	UV Light
Gramoxone	$< 10^{-7}$	Low	1,000,000	620,000	1000	None	UV light
Poast	1.6×10^{-7}	Low	100	257	5	Low	UV light
Prism	$< 10^{-7}$	Low	.23	**	3	Low	UV light
Rely	**	**	100	1,370,000	7	Low	Microbial
Roundup Ultra	1.84×10^{-7}	Low	24,000	15,700	47	Low	Microbial
Touchdown	1.84×10^{-4}	Med	700	28	70-180	Low	UV Light
2,4D amine	1.4×10^{-7}	L	100	950	10	Med	Microbial

**data unavailable

Note: see reverse side for information describing the herbicide properties listed above.