Preventing Possible Groundwater Contamination Through Management Efforts

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The potential for groundwater contamination from pesticides, including herbicides, is of concern because approximately 90% of the rural population in the United States depends upon groundwater for domestic use. Since it is very expensive to purify contaminated water, preventative measures are important for maintaining a high quality water supply. The two primary means of groundwater contamination are Point Source (PS) and Non-Point Source (NPS).

PS is any single origin of pollution such as: a pipe, ditch, channel, tunnel, well, leak in a pesticide storage facility, and discharge at sewage treatment plants and industrial facilities. Point source pollutant loads have been greatly reduced, and water quality restored and maintained, due in part to the National Pollutant Discharge Elimination System (NPDES) permit program, established by Section 402 of the Clean Water Act and regulated by the EPA and the states,

EPA and state water quality surveys in 1990 showed the majority of water quality problems in rivers, lakes, estuaries, coastal waters, and wetlands resulted from NPS pollution. Contaminated water accumulates from the transport of pollutants in runoff water, leaching, irrigation water, and seepage or hydrologic modification. It is estimated that agriculture is responsible for 65% of NPS pollution in groundwater. It is often difficult to detect NPS pollution because it can occur over a large area, usually impacted by uncontrollable weather factors. The primary factors affecting NPS include rainfall intensity and duration, vegetation cover, soil structure and texture, topography, and geology. Thus, surface water runoff will move pollutants to streams, rivers, and lakes, while groundwater will collect chemicals leaching downward through the soil.

Contamination of groundwater and surface water supplies can be reduced or prevented in agriculture by following certain guidelines adapted from EPA recommendations in 1993. They include tillage and rainfall management and pesticide management.

Tillage and rainfall management can be used to prevent herbicide movement downward through the soil profile and in runoff water. Some management options include:

1. Treat dry soil in advance of mild rainfall. Applications made before heavy rain events or on saturated soils likely to contaminate runoff water.

2. Plant cover crops, buffer strips, maintain resident vegetation, and incorporate plant residues, including at the base of irrigation ditches and canals where possible.

3. Use conventional tillage to disrupt soil macropores, so there is less water movement downward.

4. Maintain good soil organic matter to help increase sorption and herbicide degradation.

Pesticide management practices are also important for preventing contamination. Some options available include:

1. Maintain accurate records of crops, acreage treated, and herbicides used.

2. Implement IPM strategies to minimize the amount of herbicides used, including tillage or mechanical control, cover crops, weed monitoring and mapping of problem areas, use the least toxic and least mobile herbicides, reduce the spray pattern (banding, spot treatment, etc.), crop rotation, and others.

3. Consider the proximity of storage facilities to water supplies. Assess runoff potential and define areas with permeable, poorly adsorptive, and erosion prone soils.

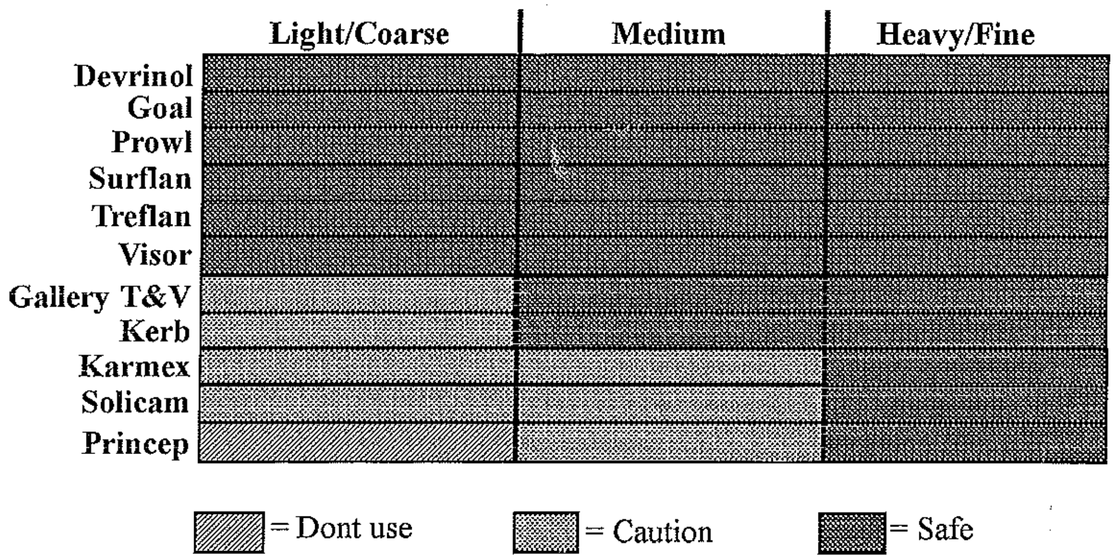
4. Prevent backflow or spillage into wells using anti-backflow devices and maintain an air-gap between the water filler hose and the spray tank.

5. Listen to weather forecasts and avoid spraying ahead of periods of heavy rainfall or on saturated soils.

6. Read and follow the label carefully and use the lowest rate whenever possible. Consult sources Regarding herbicide characteristics, including solubility, leaching potential, volatility, sorption, and persistence.

7. Perform routine maintenance and calibration of sprayers.

Soil Type Can Influence Herbicide Use Pattern and Rates



Time to Rainfall for Activation of Soil Residual Herbicides

Herbicide	Time to Rainfall
Treflan	< 24 hrs
Devrinol	< 4 days
Karmex	< 14 days
Kerb	< 14 days
Prowl	< 21days
Surflan	< 21 days
Gallery T&V	< 28 days
Goal	< 28 days
Princep	< 28 days
Solicam	< 28 days
Visor	< 28 days

Physical Characteristics of Soil Residual and Postemergence Herbicides in Grapes

	Vapor Pressure (mm Hg)	Soluability (mg/L)	Sorbtion Factor K_{oc} (mL/g)	Volatility (N,L,M,H)	Half-Life (days)	Mobility in Soil (N,L,M,H)	Primary Decomposition
Devrinol	4×10^{-6}	73	700	L	70	L	UV light
Gallery T&V*	3.9×10^{-7}	1	190-570	L	50-120	L	UV light
Goal	2×10^{-6}	.1	100,000	L	35	L	UV light
Karmex	6.9×10^{-8}	42	480	L	90	M	Microbial
Kerb	8.5×10^{-5}	15	800	M	60	L-M	Chemical
Princep	2.2×10^{-8}	6.2	130	L	91	L	UV light
Prowl*	9.4×10^{-6}	.275	17,200	M	45	L	UV light
Solicam	2.9×10^{-8}	28	700	H	70-180	H	UV light
Surflan	$< 10^{-8}$	2.6	600	L	20	L	Microbial
Treflan	1.1×10^{-4}	.3	7,000	M	45	L	UV light
Visor*	2×10^{-6}	2.5		L	64	L	Microbial
Bueno 6*	9.4×10^{-6}	.275	17,200	M	45	L	UV light
Diquat*	$< 10^{-8}$	718,000	1,000,000	N	1,000	N	UV light
Fusilade DX*	2.5×10^{-7}	1.1	5,700	L	15	L	
Gramoxone	$< 10^{-7}$	620,000	1,000,000	L	1,000	N	UV light
Poast	1.6×10^{-7}	257	100	L	5		UV light
Prism*	$< 10^{-7}$		.23	L	3		UV light
Roundup Ultra	1.84×10^{-7}	15,700	24,000	L	47	L	Microbial
Touchdown							

*Registered for use in ***non-bearing*** vineyards only