Best Practices to Keep Pesticides Out of Water

October/2020

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Water Resources Management
Atmospheric Rivers

Mediterranean Climate
- Dry Summers
- Wet Winters

Atmospheric Rivers
CALIFORNIA CLIMATE: FULL OF EXTREMES

09 Dec 2014 22:40:55
Northern Sierra Precipitation: 8-Station Index

Cumulative Precipitation (inches)

- Mount Shasta City
- Shasta Dam
- Mineral
- Quincy
- Brush Creek
- Sierraville RS
- Blue Canyon
- Pacific House

2011-2012 Normal
2012-2013 Normal
2013-2014 Normal
2014-2015 Normal
2015-2016 Normal
2016-2017
2017-2018
2018-2019

Driest Years (23-24, 76-77)

Water Year (October 1 - September 30)
KEEPING PESTICIDES OUT OF WATER
THE VARIOUS FATES OF PESTICIDES

- Evaporation/Volatilization
- Percolation/Leaching
- Plant Drift
- Uptake (absorption)
- Degradation
- Degradation
- Photo degradation
- Precipitation
- Runoff

Legend:
- Soil surface
- Root zone
- Water table
- Groundwater
- Surface runoff/erosion
- Surface water

Diagram shows the various pathways of pesticide movement in the environment.
Rain (Atmospheric River)

Injection Wells
Leaky Landfill
Piezometers
Pumping Wells
Artesian Well
Lake or River

Unconfined
Piezometers
Wells
Confining Layer
(Semi) Confined
Artesian Aquifer

Alluvial Fans - Recharge Zones

“THE SYSTEM”
Runoff – over-applying pesticides and/or overwatering (or applying pesticides right before a heavy rain) lead to runoff
Leaching – soil applied pesticides applied right before heavy rain or excess irrigation water will lead to leaching
BEST PRACTICES TO KEEP
PESTICIDES OUT OF WATER
What are some ways pesticides get into water?

- Soil properties
- Pesticide properties
- Applicator practices
- Leaching
- Runoff
- Direct channels
Soil Properties
- Soil Texture [silt, clay and sand]
- Depth to Groundwater
- Groundwater Protection Areas (GWPA)

Pesticides Properties
- Persistence [Explanation/examples]
- Solubility
- Adsorption

Application practices
- Monitoring the weather
- Irrigation practices (scheduled and monitoring system)
- Reading and following label instructions
- Good application practices (mixing and loading)
Soil Texture

California Soil Properties
Physical: Sand/Silt/Clay

Depth to Groundwater
Groundwater Information Center
Interactive Map
https://gis.water.ca.gov/app/gicima/

Shallow: 0-100 ft
Deep: > 100 ft

https://casoilresource.lawr.ucdavis.edu/ca-soil-properties/
Area that is vulnerable to the movement of pesticides to GW due to leaching or runoff.

https://www.cdpr.ca.gov/docs/emon/grndwtr/gwpa_locations.htm

<table>
<thead>
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<th>Counties with GWPAs</th>
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<tr>
<td>Butte</td>
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Persistence: Time it takes to be break down in the environment (half-life). **Solubility:** Concentration (mg/l). **Sorption:** Soil binding affinity ($K_{OC}$).

![Persistence Diagram](image)

**Initial amount**
- 100%

**After 1st half-life,**
- 50% remains

**After 2nd half-life,**
- 25% remains

**After 3rd half-life,**
- ~12% remains

**After 4th half-life,**
- ~6% remains

**After 5th half-life,**
- ~3% remains

**Low water solubility:** less than 10 mg/L or 10 ppm

**Moderate water solubility:** 10-1,000 mg/L or 10-1,000 ppm

**High water solubility:** more than 1,000 mg/L or 1,000 ppm
- Monitoring the weather
- Irrigation practices (scheduled and monitoring system)
- Reading and following label instructions
- Good handling practices (mixing and loading)
Soil Properties:
Soil Texture: e.g. Silt
Depth to GW: 17 ft. (Shallow)
GW Protection Areas: N/A

Pesticide Properties:
Persistence: Silt – 293 days (Very persistent).
Solubility: Is not very soluble. Unlikely to reach shallow GW in silty/loam and sandy soils.
Adsorption: Silt: 18,995 > 10,000 (Binds very well to soil)

National Pesticide Information Center
http://npic.orst.edu/HPT/
**Diagnostic:** Binds very well to soil and it is very persistent in the environment. Pesticide moves where the soil moves through soil erosion due to Irrigation/rainfall and/or due to drift.

**Receiving body:** Surface water, i.e. rivers and creeks

**BMPs:** Change the Pesticide?, Monitoring the weather, be conscious of irrigation practices (scheduled and monitoring system), reading and following label instructions.
Soil Properties:
Soil Texture: e.g. Silt
Depth to GW: 17 ft. (Shallow)
GW Protection Areas: N/A

Pesticide Properties:
Persistence: Silt – 107 days (Persistent).
Solubility: Is moderately soluble. Unlikely to reach shallow GW in silty/loam and sandy soils.
Adsorption: Silt: 100 ≤ 1,000 (Does not bind to soil)

Water Solubility:
Atrazine is moderately soluble in water (3.3 mg/L).¹

Vapor Pressure:
Atrazine is not very likely to volatilize or become a vapor (0.00000029 mm Hg at 25°C/77°F).²

Groundwater Ubiquity Score (GUS):
Pesticide movement in soil depends on many factors. Soil properties and pesticides properties are equally important, and these data only describe the pesticide’s properties. The more organic matter, the more slowly things tend to move. Compost is high in organic matter, while sand is not. Different soil types have different water-penetration rates. The pesticide’s ability to dissolve in water is also very important. For more information, check the “Environmental Hazards” section of the pesticide label, or call NPIC at 1-800-858-7378.

Unknown soil type:
Atrazine is likely to reach shallow groundwater in soils (soil type not specified). (4.06)⁶

Soil Half-life:
Unknown soil type:
106.65 days⁵

Sorption Coefficient (Koc):
Unknown soil type:
100⁴

National Pesticide Information Center
http://npic.orst.edu/HPT/#
**Diagnostic:** Binds very well to soil and it is very persistent in the environment. Pesticide moves where the water moves through **infiltration** due to irrigation/rainfall and/or **runoff** due to over-irrigation or high slopes.

**Receiving body:** aquifer, rivers and creeks

**BMPs:** Change the Pesticide?, Monitoring the weather, be conscious of irrigation practices (scheduled and monitoring system), reading and following label instructions.
Proper mixing, loading and storage of pesticides to make sure they don’t end up in water.
**Well head protection** – don’t apply pesticides within 100 feet of wells.
The Safe and Effective Use of Pesticides, 3rd Edition

Publication Number: 3324
Copyright Date: 2016
Length: 386 pp.
Language: English
Author: S WHITHAUS (AU) L BLECKER (TECH ED)
Inventory Type: Paperback
Availability: Available

$42.00 1  Add to Cart
Video w/this info available: https://youtu.be/z6N5g5W9JrQ

Soil texture: https://casoilresource.lawr.ucdavis.edu/ca-soil-properties/

Depth to Groundwater: https://gis.water.ca.gov/app/gicima/

Herbicides properties tool (National Pesticide Information Center) http://npic.orst.edu/HPT/

Ground Water Protection Area
https://www.cdpr.ca.gov/docs/emon/grndwtr/gwpa_maps.htm

National Weather service
https://www.weather.gov/

Safe and Effective Use of pesticides (3rd Edition)
http://ipm.ucanr.edu/IPMPROJECT/ADS/manual_safeeffectiveuse.html

Local Ag. Commissioner's office

Hydrology 101

- UC IPM –Pest Management Guidelines
https://www2.ipm.ucanr.edu/agriculture/

Reference Evapotranspiration (https://cimis.water.ca.gov/)
“Use the water that you need, but not a drop more”

“Usa el agua que necesites, pero ni una gota más”

Thanks

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