Best Management Practices to Protect Water and Fish

ATRAZINE

Broadleaf and grass herbicide, restricted use for all products containing >4% concentration

Products Include: Aatrex, Acuron, Atra, Bicep, Bullet, Callisto, Keystone, Lexar and Lumax

(Also found in some formulations of Anthem, Breakfree, Cinch, Medal, Parallel, Slider and Vilify)

ATRAZINE IS A CONCERN IN OREGON'S WILLAMETTE VALLEY STREAMS

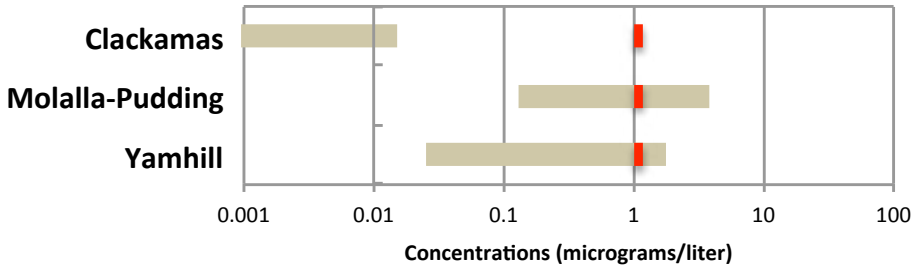
- Atrazine, together with simazine and their breakdown products, is among the top 10 pesticides detected in Willamette Basin streams.[1]
- In the Pudding River watershed, atrazine has been documented exceeding the drinking water standard.

The Chemical Properties of Atrazine Predispose It to Be a Water Pollutant

Chemical Property	Atrazine Rank[2]	Why it Matters for Pollution
Soil Persistence (half-life)	Persistent	More persistent pesticides stick around, with more opportunities to get carried to streams.
Solubility	Moderate	More soluble pesticides dissolve easily in water, moving with rainfall or soil water into streams or groundwater.
Potential to Leach	High	More leachable pesticides tend to show up in ground water.
Breakdown in Water	Resistant	Once in streams, pesticides can break down by reacting with water (hydrolysis), light (photolysis) or interacting with live organisms (metabolic). Atrazine is resistant to hydrolysis and photolysis, which means it can last longer in water.

Rank: red – yellow – green shading above indicates relative risk of pollution (red high).

Concentrations Occasionally Exceed Levels Set to Protect Aquatic Life

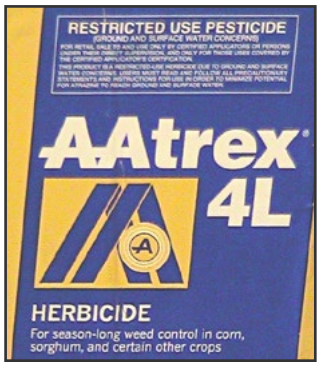


Brown bars depict average (left) to maximum (right) atrazine concentrations detected within each of the subbasins, based on stream samples collected from 2010-2015 (total 872 samples).

Aquatic Life Benchmark

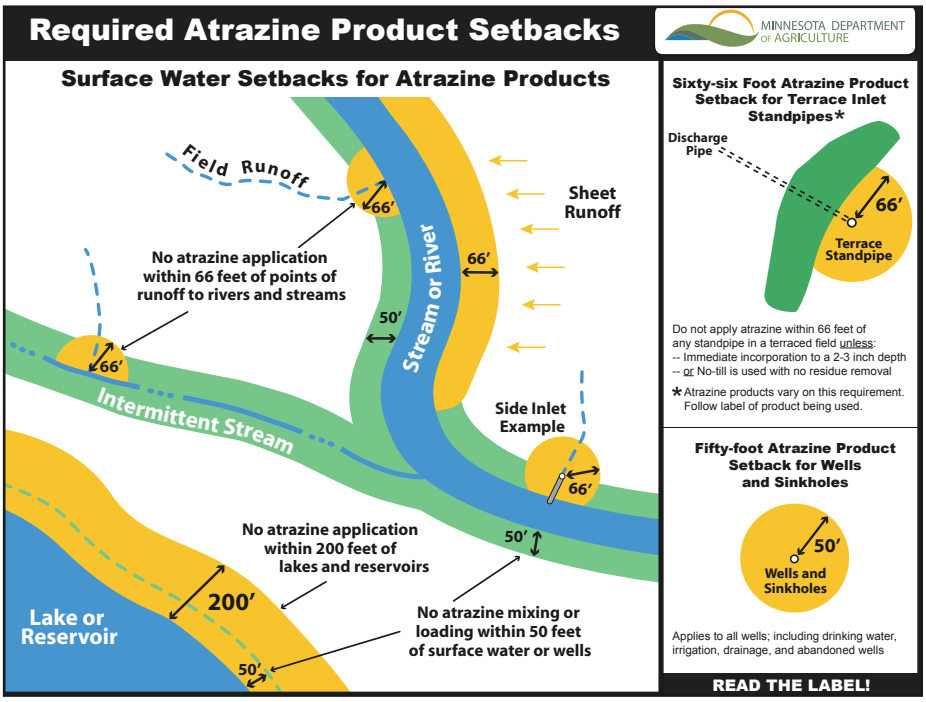
Harmful Effects of Atrazine to Salmon, Steelhead or Their Habitat

- Atrazine is toxic to aquatic plant communities, exceeding levels of concern even at reduced application rates.[3] Impacts to aquatic plant communities can result in reduced food for fish and invertebrates.
- Uses at maximum application rates may cause lethal harm to aquatic plants and fresh-water invertebrates (prey for salmon) and may result in sub-lethal impact to fish and aquatic plant communities.[4]
- Concentrations similar to the ranges found in the Willamette Valley were found to impact reproductive function in male Atlantic salmon.[5]
- Drift concerns can extend to 600 feet for impacts to non-target plants even with ground application and coarse droplets with a low boom.[6]



Pay Attention to the Label

- Labels for atrazine products **prohibit application within 66 feet** of points where field surface water runoff enters perennial or intermittent streams and rivers or **within 200 feet** of natural or impounded lakes and reservoirs. Labels also require that vegetation be planted within the buffer or setback on highly erodible land.
- Labels prohibit mixing or loading within 50 feet of wells, intermittent streams and rivers, natural or impounded lakes and reservoirs.
- Labels contain restrictions for terrace standpipes.
- Even with a 66 foot buffer, drift fractions reaching streams are estimated at 2-6%.[7]



Courtesy: Minnesota Department of Agriculture

Registered Uses in Oregon

Foods: Sweet corn, popcorn
Grasses and Forage/Fodder: Field corn, silage, sorghum, sorghum-sudan grass
Non-Crop: Roadsides, Conservation Reserve Program, fallow, industrial sites
Tree Crops: Conifers, including Christmas trees

Alternative Strategies to Reduce Weed Pressure

In addition to its harmful environmental effects, hundreds of weed species have developed resistance to atrazine, including at least one species common in Oregon.[8] Try these alternative strategies to prevent and reduce weed pressure.

- Promote plant vigor and resistance by maintaining healthy soil[9] and plant pest-resistant cultivars if available.
- Don't spread more weed seeds. Clean equipment between use sites, especially when conditions have been muddy.
- Use crop rotation to disrupt troublesome weeds. Good rotation strategies alternate crops, varying factors like: root depth and biomass; nitrogen fixing capacity, leaf density, alternate hosts, or time of sowing and development.[10] For example, slow-developing crops are susceptible to weeds and should follow weed-suppressing crops. In the Valley, summer field crops can be rotated with winter-active crops.
- Combine narrow row spacing with higher seeding rates and banded fertilizer. Trials using a combination of these techniques resulted in weed suppression six times higher than in trials using only a single practice.[11]
- Tillage can be used as a site preparation method on on flat, grassy sites for Christmas trees or forest plantations. After planting, mulches (such as wood chips, 3-4" thick) or landscape fabrics can reduce weed competition in new plantings and retain moisture (but may promote rodents).[12]
- Plant permanent grass or cover crop strips between Christmas or woodlot tree rows to reduce competition from more aggressive weeds.[13]
- Scalping at least three feet circles around each tree seedling, followed by mulch can slow competition from grasses and herbaceous weeds.
- Try using shallow cultivation, flame weeding or mowing to address weeds where feasible.

Protect Fish – Keep it Out of the Water

Suggested Best Management Practices

Especially adjacent to permanent water bodies, sloped sites or on bare or erodible soils

Reduce Runoff:

1. Reduce application rates, spot spray or conduct banded applications, striving for less than 0.5 lb a.i/A to reduce impacts to aquatic plant communities. Soil incorporation to depths > 2.4 inches can reduce atrazine runoff.[14]
2. Avoid application when soils are close to saturation or when significant rainfall is expected.
3. Slow and infiltrate runoff from treated sites. Techniques include:
   -Strip cropping (strips of perennial vegetation alternated with cultivated strips on contours),
   -"Perms" (grass strips) or cover crops between rows of Christmas trees or conifer plantations,[15]
   -Reduced-tillage, which helps maintain organic material on site, promoting infiltration,
   -Straw ropes laid across the contour on sloped forestry or Christmas tree sites to slow runoff.[16]
4. Infiltrate concentrated, channeled runoff leaving the treated sites using grassed waterways.[17]
5. Install permanent vegetative buffer strips of grass or native trees/shrubs between the application site and aquatic areas. Such strips trap sediment and promote infiltration, reducing pesticide loading to adjacent ditches and streams. While large variabilty exists, a review found, on average:[18]
   -a 17 ft. wide vegetative strip reduces pesticide loading by 50%,
   -a 33 ft. wide vegetative strip reduces pesticide loading by 90%,
   -a 67 ft. wide vegetative strip reduces pesticide loading by 97%.

Reduce Drift:

1. Apply by ground rather than air. In conifers, predicted aquatic concentrations drop by 2/3 when atrazine is applied by ground.[19]
2. Apply only when wind speeds are between 2-8 mph, only when winds are blowing away from streams and only when temperatures are lower than 70°F.
3. Increase untreated setbacks (no-spray buffers) next to streams, especially for aerial applications or if no windbreak or drift barrier is present. Increasing the setback from 66 feet to 200 feet can reduce the drift fraction reaching streams by about half.[20]
4. Use shields, precision sprayers or other drift reduction technology. Adjust nozzles to coarse droplet sizes.

Pesticide Selection:

1. Use a product that is less persistent and less toxic (check SDS sheets or talk to your crop consultant or extension specialist).
2. Avoid tank mixes and formulations containing multiple active ingredients, which may cause additive or synergistic effects.

1 Oregon Pesticide Stewardship Partnership Program data, 2010-2015. Samples collected 7-14 days apart during growing season. Sampling sites may not represent first-order streams and small, static, water bodies adjacent to atrazine use areas, thus sampling data may underestimate true peaks and averages. EPA considers atrazine to be structurally similar and of equal toxicity to simazine and propazine.

2 Solubility, soil half-life, hydrolysis and photolysis values from EPA 2016. Refined Ecological Risk Assessment for Atrazine. April 20, 2016. p. 63-71; also see p. 188. Rankings follow National Pesticide Information Center (NPIC) classification. Leachability based on movement rating from Pesticide Properties Database at: http://npic.orst.edu/ingred/ppdmove.htm.

3 EPA Ecological Risk Assessment (endnote 2) p. 28.

4 EPA Ecological Risk Assessment (endnote 2) pp. 327-328.

5 Moore, A. and Lower, N. 200. The impact of two pesticides on olfactory-mediated endocrine function in mature male atlantic salmon (Salmo salar L.) parr. Comp. Biochem. Physiol. B 129:269:276.

6 EPA Ecological Risk Assessment (endnote 2) p. 29.

7 EPA Ecological Risk Assessment (endnote 2) p. 73.

8 International Survey of Herbicide Resistant Weeds. http://www.weedscience.org.

9 Magdoff, F. and H. Van Es. 2009. Building Soil for Better Crops. USDA SARE program, http://www.sare.org/Learning-Center/Books/Building-Soils-for-Better-Crops-3rd-Edition.

10 Mohler, C. and S. Johnson. 2009. Crop rotation on organic farms. http://www.sare.org/Learning-Center/Books/Crop-Rotation-on-Organic-Farms.

11 Anderson, R. 2003. An ecological approach to strengthen weed management in the semiarid Great Plains. Advances in Agronomy 80: 33-62.

12 Oregon State University Extension. 2014. Introduction to Conifer Release. EC1388. Also see Iowa State University Forestry Extension. Weed Control for Seedlings.

13 Ibid.

14 EPA Ecological Risk Assessment (endnote 2) p. 88.

15 Pacific Northwest Extension Publication PNW 625. 20. Weed and Vegetation Management in Christmas Trees.

16 Ibid.

17 Natural Resources Conservation Service. 2000. Conservation Buffers to Reduce Pesticide Losses.

18 European Crop Protection Association, 2009. Vegetative Buffer Strips, http://abe.ufl.edu/Carpena/files/pdf/software/vfsmod/VFS_Flyer_07_09_09__FINAL.pdf.

19 EPA Ecological Risk Assessment (endnote 2) p. 323.

20 AgDrift model, EPA Ecological Risk assessment (endnote 2), p. 73.

Northwest Center for Alternatives to Pesticides

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NCAP works to protect community and environmental health and inspire the use of ecologically sound solutions to reduce the use of pesticides.

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