Best Management Practices to Protect Water and Fish

METHOMYL

Broad-spectrum insecticide, mostly restricted use

Products Include:
General Use: Deosect, Starbar, Stimukil
Restricted Use: Annihilate, Corrida, Lannate, Lemur, M1, Nudrin

Methomyl is a Concern in Oregon's Willamette Valley Streams

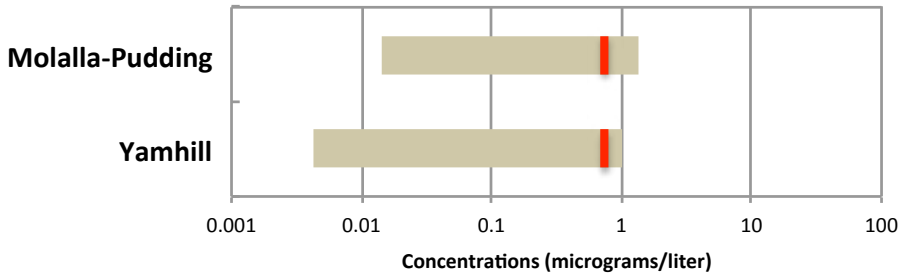
The National Marine Fisheries Service (NMFS) determined methomyl jeopardizes the continuing existence of five threatened species of Chinook salmon, coho salmon and winter steelhead found in the Willamette Basin, as well as their designated critical habitat, based on the toxic effects of methomyl at predicted aquatic concentrations and exposure potential.[1]

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

Chemical Property	Methomyl Rank[2]	Why it Matters for Pollution
Solubility	High	More soluble pesticides dissolve easily in water, moving with rainfall or soil water into streams or groundwater.
Soil Persistence (half-life)	Moderate	More persistent pesticides stick around, with increased opportunities to get carried to streams.
Potential to Leach	Moderate	More leachable pesticides tend to show up in groundwater.

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

Methomyl Concentrations Occasionally Exceed Levels Set to Protect Aquatic Life[3]



Brown bars depict average (left) to maximum (right) methomyl concentrations detected within each of the subbasins, based on stream samples collected from 2010-2015 (total 872 samples). Methomyl was not detected in the Clackamas subbasin samples.

Aquatic Life Benchmark

Harmful Effects of Methomyl to Salmon, Steelhead or Their Habitat

Simulations indicate that initial concentrations after ground applications adjacent to shallow, low-flow habitats (which salmon and steelhead fry prefer for rearing) could reach levels high enough to kill aquatic insect prey, even with no-spray buffers required on the labels.[4]

Photo: Bureau of Land Management

Pay Attention to the Label

All methomyl labels warn that the chemical is **toxic to fish and aquatic invertebrates**, and warn that drift and runoff may be hazardous to aquatic organisms. Labels warn of known groundwater contamination on permeable soils, particularly where the water table is shallow.

Labels also warn of potential aquatic contamination through spray drift and state that methomyl:

> …may also have a **high potential for runoff into surface water for several days to weeks after application [to] poorly draining or wet soils** with readily visible slopes toward adjacent surface waters, frequently flooded areas, areas overlaying extremely shallow groundwater, areas with in-field canals or ditches that drain to surface water, areas not separated from adjacent surface waters with vegetated filter strips, and areas overlaying tile drainage systems that drain to surface water.

Labels for field uses require certain drift reduction measures and specify no-spray buffers:

> Do not apply by ground equipment within 25 feet, or by air within 100 feet of lakes, reservoirs, rivers, estuaries, commercial fish ponds and natural, permanent streams, marshes or natural, permanent ponds. Increase the buffer zone to 450 feet from the above aquatic areas when ultra low volume application is made.

Applications of methomyl are subject to a 2014 court order for interim salmon protection that **requires no-spray buffers adjacent to salmon-supporting waters (60 feet for all ground or granular applications and 300 feet for all aerial applications).** See maps and information online at Salmon Mapper.[5]

Registered Uses in Oregon

Foods: Wide variety of vegetables, some fruits, blueberries, grapes, apples, peaches, various cereals
Structures/Urban: Fly bait (commercial or farm buildings and food processing areas)
Other: Field corn, hay, silage, sudan grass, alfalfa, turf (sod farms only)

Alternative Strategies to Reduce Insect Pressure

- Promote plant vigor by maintaining healthy soil[6] and plant pest-resistant cultivars if available.
- Prevent or suppress pests with cultural strategies, where possible and recommended, to make the area less hospitable to the pest. For example, delaying planting dates can inhibit pests such as flea beetles and cabbage maggots. Certain crop rotations interrupt the life cycle for corn rootworm, wireworms, Colorado potato beetle, and symphylans.[7] Removing known alternate hosts reduces pest resources.
- Pheromones (chemicals produced by an insect to communicate) can be used in many crops for monitoring–or for mass trapping or mating disruption, suppressing insect populations.[8] Mating disruption for codling moth is currently used on 90% of the apples and pears grown in Washington State.
- Use exclusions or barriers where feasible.
- Support biological pest control by natural enemies (predators or parasites on the pest). Many biocontrols can be purchased from commercial providers. Conserving or creating on-farm habitats (such as beetle banks, cover crops, alley cover crops or hedgerows) supports native natural enemies (conservation biocontrol).[9] Such habitats also provide habitat for native pollinators, important to many Oregon crops. Research appropriate plants to ensure the biocontrol habitats don't increase host plants for pests of concern.
- Mass-trap pests using trap crops, pheromone technology or baits. For example, in Washington and Idaho, trap crop designs including mustard, rape and pak choi were found to reduce populations of flea beetles on broccoli more effectively than trap crops with only one species.[10]
- Check with Oregon State, Washington State or University of California extension for advice on specific pests.

Protect Fish – Keep it Out of the Water

National Marine Fisheries Service Recommendations to Protect Salmon[11]
Do not apply by ground within 50 feet or by air within 600 feet of salmonid habitats when water exists in the stream or habitat.
Do not apply when wind speeds are 10 mph or greater measured immediately prior to application.
Do not apply when soil moisture is at field capacity or when a storm event likely to produce runoff from the treated area is forecasted within 48 hours following application.
Report all incidents of fish mortality that occur within four days of application and within the vicinity of the treatment area to EPA Office of Pesticide Programs (703.305.7695).

Willamette River | Photo: Aaron Hockley

Additional Suggested Best Management Practices

Especially adjacent to permanent water bodies, on sloped or frequently flooded sites, where the water table is shallow, or on permeable or bare soils

Reduce Runoff and Erosion:

1. Reduce application rates, spot spray or conduct banded applications.
2. Avoid application when run-off generating rainfall is expected.
3. Techniques to promote infiltration and reduce erosion include:
   -Strip cropping (strips of perennial vegetation alternated with cultivated strips on contours),
   -"Perms" (grass strips) or cover crops between rows of berries, orchard crops, or vineyards,
   -Reduced-tillage, which helps maintain organic material on site, holding soil in place,
   -Straw ropes, laid across the contour on sloped sites, to slow runoff and erosion.
4. Infiltrate concentrated, channeled runoff leaving the treated sites using grassed waterways.[12] Sediment-control measures such as grass-filter strips or sediment-retention ponds can be helpful. Such techniques trap sediment and promote infiltration, reducing pesticide loading to adjacent ditches and streams. While large variability exists, a review found, on average:[13]
   -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 and Volatilization:

1. Apply by ground rather than air.
2. Apply only when wind speeds are between 2-8 mph and only when winds are blowing away from streams.
3. Adjust nozzles to coarse droplet sizes. For airblast sprayers, airflow adjustment is important. Studies in grapes show airflow adjustments resulting in 82% improvement in spray deposition, with a corresponding spray drift reduction of 70%.[14] Also, use shields, precision or "smart" sprayers or other drift reduction technology. Tunnel sprayers designed to contain and recycle spray over berry and vineyard rows also result in far less drift than conventional airblast sprayers, reducing drift by up to 95%, and reducing chemical usage by 40%.[15]
4. Increase untreated setbacks (no-spray buffers) next to streams, especially for aerial applications or if no windbreak or drift barrier is present. A setback of 100 feet for ground and aerial applications reduces the modeled drift fraction to about 6% for ground applications and 28% for aerial applications, respectively. A setback of 300 feet for aerial applications reduces the drift fraction to about 1%.[16]

Pesticide Selection:

1. Use a pesticide that is less persistent and less toxic (check SDS sheets or talk to your crop consultant or extension specialist). Botanical extracts and microbials are effective against many pests and widely available, and these products can be less toxic to non-targets.
2. Avoid tank mixes and formulations containing multiple active ingredients, which may cause additive or synergistic effects.

1 U.S. National Marine Fisheries Service. 2009. Endangered Species Act Section 7 Consultation Biological Opinion, Environmental Protection Agency Registration of Pesticides Containing Carbaryl, Carbofuran and Methomyl. http://www.nmfs.noaa.gov/pr/pdfs/carbamate.pdf.

2 Solubility and soil half-life values from EPA, cited in National Marine Fisheries Service (endnote 1, p. 273), rankings follow National Pesticide Information Center (NPIC) classification. Leaching potential and ranking from Groundwater Ubiquity Score (GUS) at University of Hertfordshire Pesticide Properties Database.

3 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 pesticide use areas, thus sampling data may underestimate true peaks and averages.

4 U.S. National Marine Fisheries Service, 2009, pp. 290-291, (endnote 1).

5 U.S. EPA. Salmon Mapper: Pesticide Use Limitations in California, Oregon and Washington State. https://www.epa.gov/endangered-species/salmon-mapper.

6 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.

7 Stoner, K. 2009. Management of insect pests with crop rotation and field layout. http://www.sare.org/Learning-Center/Books/Crop-Rotation-on-Organic-Farms/Text-Version/Physical-and-Biological-Processes-In-Crop-Production/Management-of-Insect-Pests-with-Crop-Rotation-and-Field-Layout. Also see Umble J. [and others]. 2006. Symphylans: Soil Pest Management Options. https://attra.ncat.org/attra-pub/viewhtml.php?id=127ATTRA.

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9 Mader, E., J. Hopwood [and others]. 2014. Farming with native beneficial insects. The Xerces Society: Storey Publishing.

10 Parker, J., D. Crowder [and others]. 2016. Trap crop diversity enhances crop yield. Agriculture, Ecosystems and Environment 232:254-262. http://entomology.wsu.edu/david-crowder/files/2016/09/2016_parker-et-al_ag-ecosyst-environ.pdf.

11 U.S. National Marine Fisheries Service, 2009, Reasonable and Prudent Alternative, summarized from pp. 487-495 (endnote 1).

12 USDA Natural Resources Conservation Service. 2000. Conservation Buffers to Reduce Pesticide Losses. https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_023819.pdf.

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

14 Landers, A. 2011. Improving Spray Deposition with Engineering Innovation. https://grapesandwine.cals.cornell.edu/sites/grapesandwine.cals.cornell.edu/files/shared/documents/Landers-Research-Focus-2011-1.pdf.

15 Ade, G., G. Molari, and V. Rondelli. 2005. Vineyard evaluation of a recycling tunnel sprayer. American Society of Agricultural Engineers. 48(6): 2102-2112. See also Vicksta, M. 2015. Yamhill Soil and Water Conservation District. 2012. Recycling Tunnel Sprayer Results Report, CIG.

16 U.S. National Marine Fisheries Service. 2009, p. 492 (endnote 1).

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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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