Best Management Practices to Protect Water and Fish

IMIDACLOPRID

Insecticide/miticide, some restricted use labels

Selected Agricultural Products Include: Acceleron, Admire, Couraze, Criterion, Dominion, Gaucho, Merit, Malice, Marathon, Montana, Nuprid, Provado **Home and Garden products:** Numerous products made by Bonide, Fertilome, Hi-Yield, Ortho, and others **Pet products:** Numerous products
Total of 391 products registered in Oregon

Imidacloprid is a Concern in Oregon's Willamette Valley Streams

- Imidacloprid moves into streams easily and is one of the top ten most frequently detected pesticides in streams of the north Willamette Valley, detected in almost 20% of samples collected between 2010-2015.[1]
- Average concentrations of imidacloprid measured in Willamette Valley streams between 2010-2015 exceed levels known to harm key salmon and steelhead prey.[2]

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

Chemical Property	Imidacloprid Rank[3]	Why It Matters for Pollution
Solubility	Moderate	More soluble pesticides dissolve easily in water, moving with rainfall or soil water into streams or groundwater.
Soil Persistence (half-life)	Persistent	More persistent pesticides stick around, with increased opportunities to get carried to streams.
Potential to Leach	High	More leachable pesticides tend to show up in groundwater.

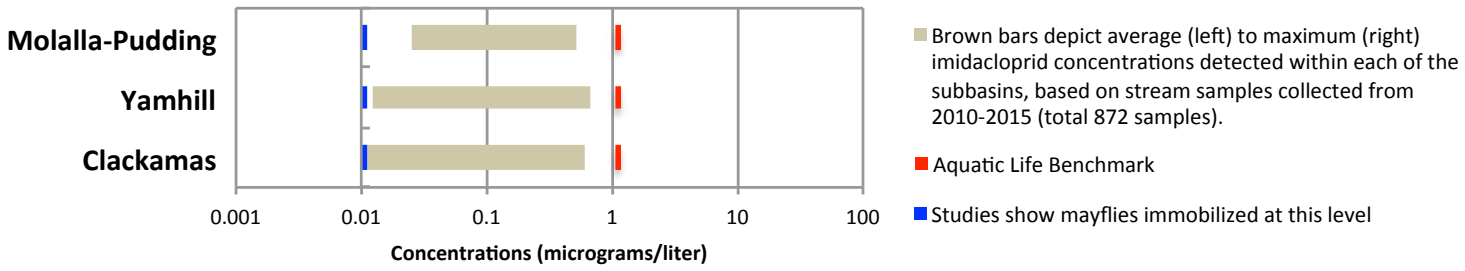
Rank: red – yellow – green shading above indicates relative risk of pollution (red high).

Harmful Effects of Imidacloprid to Salmon, Steelhead or Their Habitat

- Aquatic insects, especially mayflies, midges and stoneflies (all important food for salmon and steelhead) are especially sensitive to imidacloprid.[4] Mayflies can be immobilized at very low levels, below the average imidacloprid concentrations detected in Willamette Valley streams between 2010-2015. Effects on survival, growth and emergence rate for other prey, such as midges, have been documented within the range of concentrations detected in the Willamette Basin stream samples.[5]
- Foliar applications, followed by soil applications at shallow depths (<0.75 inch) are most likely to cause high concentrations in nearby streams. Some of the highest stream residue concentrations are expected after foliar applications to tree fruits, Christmas trees, tree plantations, and nurseries, partly due to the higher rates allowed for these uses. Application scenarios involving a combination of foliar, soil or seed coating applications also are expected to result in concerning levels of off-site contamination for all crops, with combined treatments in root and tuberous vegetables and some leafy greens being of particular concern.[6]

photo: Bureau of Land Management

Important Prey Species Are Affected Below Average Detected Concentrations



Pay Attention to the Label

- Most imidacloprid labels warn that the chemical is **highly toxic to aquatic invertebrates** and warn that the product may result in groundwater contamination.
- Some labels **require no-spray buffers (25 feet for ground applications and 150 feet for aerial applications)** adjacent to lakes, reservoirs, rivers, permanent streams, marshes, ponds, or estuaries. Other labels **prohibit application to saturated soils and prohibit over-irrigation or prohibit runoff or puddling following application.**
- Some labels prohibit cultivation within 10 feet of the aquatic area to allow for growth of a vegetative filter strip.
- Products meant for **urban outdoor uses prohibit allowing the pesticide to runoff into storm drains, ditches, gutters**, or surface waters.
- Some labels specify drift reduction methods.

Registered Uses in Oregon

Foods: A wide range of vegetables, grapes, berries, filberts, some cereals, tree fruits, hops
Nurseries and Ornamental: Nursery, greenhouse, container agriculture, sod farm
Tree Crops: Forestry, poplar, Christmas trees
Residential/Urban: Structural and landscape treatments, turf, ornamentals, fabric, houseplants, golf courses
Other: Rights-of-way (railroad, roadside, utility), recreation area, boat, animal quarters, grain storage, firewood, fencerow, wood products, rodent burrows, cats, dogs, public health

Alternative Strategies to Reduce Insect Pressure

- Treat the cause of the problem first. For example, in structures, prevent or fix wood moisture issues and don't allow ants or cockroaches to access food.
- Promote plant vigor and resistance by maintaining healthy soil[7] and plant pest-resistant cultivars if available.
- Prevent or suppress insects or mites 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 wireworms, Colorado potato beetle and symphylans.[8] Managing against known alternate hosts reduces pest habitat. Pests such as spider mites thrive under dusty or dry conditions, so employ dust control methods and provide adequate water.
- Use exclusions or barriers. For example, trees that drip sticky "honeydew" can be base-coated with a sticky barrier to prevent ant access and reduce aphid honeydew production.
- Avoid perimeter sprays around buildings for pests such as ants. Seal openings or use baits instead.
- Pheromones (chemicals produced by an insect to communicate) can be used in many agricultural crops for mass trapping or mating disruption, suppressing insect populations.[9] Mating disruption for codling moth is currently used on 90% of the apples and pears grown in Washington State.

- 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).[10] Such habitats also provide resources 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.
- Systems such as banker plants in greenhouses allow ongoing rearing of natural enemies.
- Mass-trap pests using trap crops, pheromone technology or baits. Mass-trapping with the aid of a pheromone was found to significantly reduce western flower thrip in strawberries.[11] 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.[12]
- Check with Oregon State, Washington State or University of California extension for advice on specific pests.

Predatory mites, applied in small sachets, fight thrips on ornamental starts.

Protect Fish – Keep it Out of the Water

Suggested Best Management Practices

Especially adjacent to permanent water bodies, or where the water table is shallow, or on impervious sites or bare soils or highly permeable sites

Reduce Drift:

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%.[13] 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%.[14]
4. Mitigate "dust-off" of imidacloprid-treated seed. Options include applying the treatment immediately prior to planting as a liquid or slurry treatment and/or avoiding dust formulations, both of which can reduce dust drift to aquatic areas.[15] Seed flow lubricants can also reduce dust drift by reducing treated seed abrasion.[16]
5. 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 25 feet for ground and air-blast applications reduces the modeled drift fraction to about 3% and 1.5%, respectively. A setback of 150 feet for aerial applications reduces the drift fraction to about 4%.[17]

Reduce Runoff and Erosion:

1. Reduce application rates, spot spray, or conduct banded or bait applications instead of broadcast.
2. Seeds coated with imidacloprid should be incorporated to a depth of at least 0.75 inch to reduce runoff potential.[18] Any spilled seed should be cleaned up or incorporated.
3. Avoid application on impervious (hardened) or saturated surfaces, especially when significant rainfall is expected. Avoid application to hardened sites in urban or residential areas. Avoid foliar applications when run-off generating rainfall is expected.
4. 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 conifer plantations, berries, orchard crops or grapes,[19]
   -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.[20]
5. Infiltrate concentrated, channeled runoff leaving the treated sites using grassed waterways.[21] 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:[22]
   -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%.

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 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 imidacloprid use areas, thus sampling data may underestimate true peaks and averages.
2 Roessink I., L. Merga [and others]. 2013. The neonicotinoid imidacloprid shows high chronic toxicity to mayfly nymphs. Environ. Toxicol. Chem. 32: 1096–100.
3 Solubility and soil half-life and values from US EPA 2017 (endnote 4); rankings follow National Pesticide Information Center (NPIC) classification. Leaching potential and ranking from Groundwater Ubiquity Score (GUS) at University of Hertfordshire Pesticide Properties Database.
4 U.S. EPA. 2017. Preliminary Aquatic Risk Assessment to Support the Registration Review of Imidacloprid. https://www.regulations.gov/document?D=EPA-HQ-OPP-2008-0844-1086, pp. 79-80.
5 Ibid, pp. 75-81.
6 Ibid, pp. 94-99.
7 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.
8 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.
9 Washington State University. Mating Disruption. http://jenny.tfrec.wsu.edu/ opm/displaySpecies.php?pn=-80.
10 Mader, E., J. Hopwood [and others]. 2014. Farming with native beneficial insects. The Xerces Society: Storey Publishing.
11 Sampson C. and W. Kirk. 2013. Can mass trapping reduce thrips damage and is it economically viable? Management of the Western flower thrips in strawberry. PLoS ONE 8(11): e80787. https://doi.org/10.1371/journal.pone.0080787.
12 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.
13 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.
14 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.
15 U.S. EPA. 2017, p. 148 (Endnote 4).
16 American Seed Trade Association and CropLife America [undated]. The guide to seed treatment stewardship. http://seed-treatment-guide.com/wp-content/uploads/2017/03/ASTA_Seed_Guide_Farmers.pdf.
17 U.S. EPA. 2017, p. 39 (Endnote 4).
18 U.S. EPA. 2017, p. 112 (Endnote 4).
19 Pacific Northwest Extension Publication PNW 625. 2011. Weed and Vegetation Management in Christmas Trees.
20 Ibid.
21 USDA Natural Resources Conservation Service. 2000. Conservation Buffers to Reduce Pesticide Losses. https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_023819.pdf.
22 European Crop Protection Association. 2009. Vegetative Buffer Strips. http://abe.ufl.edu/Carpena/files/pdf/software/vfsmod/VFS_Flyer_07_09_09__FINAL.pdf.

NORTHWEST CENTER FOR ALTERNATIVES TO PESTICIDES

June 2017. Financial support for the development of this document was provided by:
The Oregon Pesticide Stewardship Partnership Program, Spirit Mountain Community Fund and Jubitz Family Foundation.

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

WWW.PESTICIDE.ORG | INFO@PESTICIDE.ORG