



## Best Management Practices to Protect Water and Fish

# DIURON

Pre-emergent and post-emergent herbicide

Products Include: Dibro, Direx, Karmex, Krovar, Imazuron, Parrot, Sahara, Weed Blast

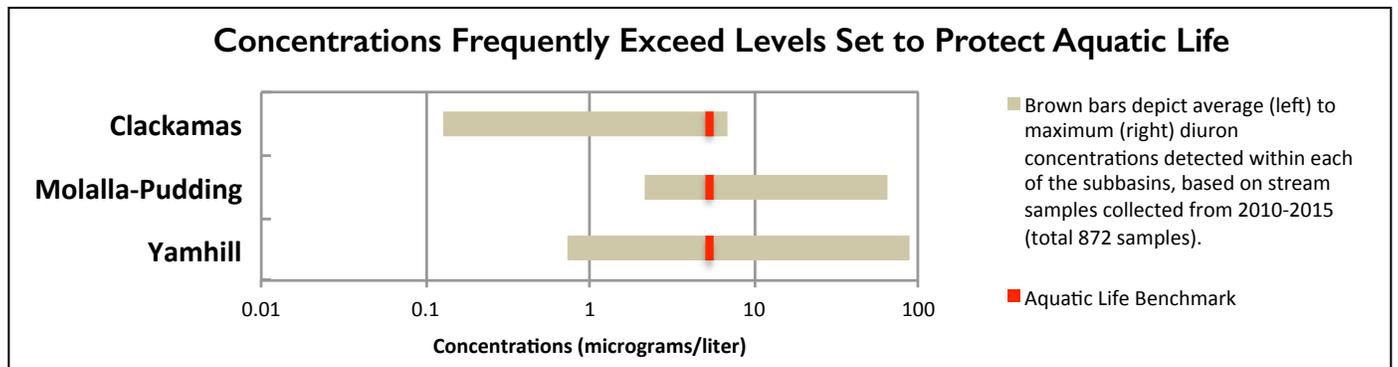
### DIURON IS A PROBLEM IN OREGON'S WILLAMETTE VALLEY STREAMS

- Diuron was found in nearly all (88%) stream samples collected in the north Willamette Valley between 2010-2015.<sup>1</sup>
- The National Marine Fisheries Service (NMFS) determined diuron harms critical habitat designated for four threatened species of Chinook salmon and winter steelhead found in the Willamette Basin, based on the toxic effects of diuron at predicted aquatic concentrations and exposure potential.<sup>2</sup>

#### The Chemical Properties of Diuron Predispose It to Be a Water Pollutant

Chemical Property	Diuron Rank <sup>3</sup>	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	Moderate	More leachable pesticides tend to show up in groundwater.
Breakdown in Water	Resistant	Once in streams, pesticides can break down by reacting with water (hydrolysis), light (photolysis) or interacting with live organisms (metabolic). Diuron is resistant to hydrolysis.

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



#### Harmful Effects of Diuron to Salmon, Steelhead or Their Habitat

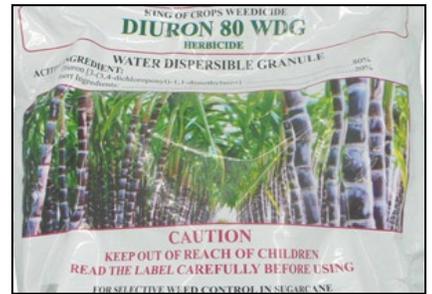
In its Biological Opinion examining the impacts of diuron to threatened steelhead and salmon, the National Marine Fisheries Service concluded that:<sup>4</sup>

- Diuron will directly kill fish in some habitats (juveniles are most vulnerable).
- Diuron may reduce juvenile (fry) growth and development directly as well as through impacting the prey base.
- Diuron may impact the sense of smell.
- Diuron will depress plants and algae, which are eaten by salmon prey.
- Diuron will alter riparian habitat, affecting aquatic communities.



## PAY ATTENTION TO THE LABEL

- Diuron labels contain mandatory drift reduction specifications.
- Some diuron labels warn against contaminating irrigation ditches or water used for domestic purposes.
- Some labels warn that drift and runoff may be hazardous to wildlife or plants in adjacent aquatic areas.
- Some labels contain restrictions for uses on gravelly, sandy or coarse soils, as well as soils low in organic matter.



## REGISTERED USES IN OREGON

**Foods:** A variety of cereal grains, berries, wine grapes, tree nuts, vegetables, and tree fruit

**Grasses and Forage/Fodder:** Grass seed, red clover, alfalfa, others

**Non-Crop:** Industrial and rights-of-way (roads, rails and utility)

**Tree Crops:** Poplars

## ALTERNATIVE STRATEGIES TO REDUCE WEED PRESSURE

- Promote plant vigor and resistance by maintaining healthy soil<sup>5</sup> and plant pest-resistant cultivars if available.
- Don't spread weed seeds. Use high-quality seed certified to have low weed content (<0.25%). Clean equipment between use sites, especially when conditions have been muddy. Prevent weed seed set using mowing or cultivation.
- Rotate crops to interrupt weed cycles. 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.<sup>6</sup> For example, slow-developing crops are susceptible to weeds and should follow weed-suppressing crops. In the Willamette Valley, summer field crops can be rotated with winter-active crops.
- Rotate grass seed and cereal grains with pulses or oilseeds.
- Use desirable cover or companion crops to occupy space during the time it takes to establish slower growing crops. Slow-establishing grasses grown for seed may be grown in alternate rows with small grain cereals or annuals to minimize weed establishment and provide earlier income, as was common before herbicides. According to Oregon State University, good commercial combinations include: wheat with orchardgrass and meadowfoam with perennial ryegrass.<sup>7</sup>
- Control weeds in an early, vulnerable seedling state. Non-herbicidal strategies include shallow cultivation and flameweeding.
- Flameweeding is useful for destroying biomass, as well as reducing competition; flameweeding is used as a primary strategy by the Walla Walla Irrigation District to manage vegetation in ditches (formerly the district used diuron).
- Mowing can be used in fields to prevent seed set and is a useful alternative practice on roadsides.
- Between rows in orchards, vineyards and berries, establish permanent grass strips, mulches (such as wood chips, 3-4" thick) or cover crops to outcompete unwanted weeds and promote infiltration.



Brush mowing is a viable alternative for roadside vegetation management | Photo: Gilbert

## PROTECT FISH – KEEP IT OUT OF THE WATER

### National Marine Fisheries Service Recommendations to Protect Salmon<sup>8</sup>

Avoid broadcast applications unless there is minimal potential for drift to listed salmonid-bearing waters. Do not apply when wind speeds are below 2 mph or exceed 10 mph, except when winds in excess of 10 mph will carry drift away from salmonid-bearing waters.

Do not apply products containing diuron when soil is saturated or precipitation likely to produce direct runoff to salmonid-bearing waters from the treated area is forecasted within 48 hours following application.

Do not apply diuron directly to native riparian vegetation.

Do not apply diuron to intermittently flooded, low lying sites, marshes, swamps, and bogs that may be seasonally connected to habitats that contain listed salmonids.



Photo: Pacific Northwest National Laboratory

### Additional Suggested Best Management Practices

*Especially adjacent to permanent water bodies, sloped sites, bare or porous soils, or sites with low organic matter*

#### Reduce Drift:

1. Apply by ground rather than air. Spray at the lowest feasible height.
2. Apply only when wind speeds are between 2-8 mph and only when winds are blowing away from streams. Avoid applications when temperatures are higher than 70°F.
3. Use untreated setbacks next to aquatic habitat. Setbacks of 60 feet for ground applications and 300 feet for aerial applications can reduce drift to surface streams by 97-99%.<sup>9</sup>
4. Use shields, precision sprayers or other drift reduction technology. Adjust nozzles to coarse droplet sizes.

## Reduce Runoff and Erosion:

1. Reduce application rates, spot spray or conduct banded applications.
2. Avoid application on impervious surfaces, especially when significant rainfall is expected.
3. Apply diuron when soils have some moisture, but not when soils are saturated or a runoff-generating rainfall is expected.
4. Runoff from treated sites can be reduced with a variety of techniques, including:
  - Strip cropping (strips of perennial vegetation alternated with cultivated strips on contours),
  - “Perms” (grass strips) or cover crops between rows of fruit or nut trees, berries or grapes,
  - Reduced-tillage, which helps maintain organic material on site, improving infiltration,
  - Straw ropes laid across the contour on sloped sites, to slow runoff and erosion.
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 variability exists, a review found, on average:<sup>10</sup>
  - 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).
2. Avoid tank mixes and formulations containing multiple active ingredients which may cause additive or synergistic effects.
3. Avoid use of wettable powders and microgranular formulations, which show higher runoff tendencies.



Soil Erosion | Photo: East Multnomah Soil and Water Conservation District

- 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 pesticide use areas, thus sampling data may underestimate true peaks and averages.
- 2 U.S. National Marine Fisheries Service. 2011. Endangered Species Act Section 7 Consultation Biological Opinion: Environmental Protection Agency Registration of Pesticides 2,4-D, Triclopyr, BEE, Diuron, Linuron, Captan, and Chlorothalonil. See page 774. [http://www.nmfs.noaa.gov/pr/pdfs/consultations/pesticide\\_opinion4.pdf](http://www.nmfs.noaa.gov/pr/pdfs/consultations/pesticide_opinion4.pdf).
- 3 Solubility, soil half-life and leaching values and ranking from National Pesticide Information Center (NPIC). Hydrolysis value from NMFS, 2011 (Endnote 2).
- 4 NMFS, 2011 (Endnote 2).
- 5 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>.
- 6 Molher, C. 2012. The role of crop rotation in weed management. <http://www.sare.org/Learning-Center/Books/Crop-Rotation-on-Organic-Farms/Text-Version/Physical-and-Biological-Processes-In-Crop-Production/The-Role-of-Crop-Rotation-in-Weed-Management>.
- 7 Oregon State University Grass Seed Crops: [http://cropandsoil.oregonstate.edu/sites/default/files/classes/css460-560/Chapter\\_4.pdf](http://cropandsoil.oregonstate.edu/sites/default/files/classes/css460-560/Chapter_4.pdf).
- 8 NMFS, 2011, pp. 775-780 (Endnote 2).
- 9 Ibid., pp. 413-415 (Endnote 2).
- 10 European Crop Protection Association, 2009. Vegetative Buffer Strips, [http://abe.ufl.edu/Carpena/files/pdf/software/vfsmod/VFS\\_Flyer\\_07\\_09\\_09\\_FINAL.pdf](http://abe.ufl.edu/Carpena/files/pdf/software/vfsmod/VFS_Flyer_07_09_09_FINAL.pdf).

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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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