



Applying knowledge to improve water quality

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Pacific Northwest

Regional Water Program

A Partnership of USDA CSREES
& Land Grant Colleges and Universities

Using Green Manure Crops to Reduce Synthetic Pesticides

In 2006, 3,900 acres in Idaho used biofumigants instead of synthetic soil fumigants to suppress nematodes, soil borne diseases, and weeds impacting 20 percent of the potato acreage in eastern Idaho. In 2007 through 2009, 8,300 acres were planted in Idaho each year to biofumigants. The implementation of this Integrated Pest Management (IPM) practice has reduced the use of synthetic pesticides in eastern Idaho potato producing counties and the Treasure and Magic Valleys of Idaho on an average of 20 percent each year. Growers have found that by utilizing the USDA Natural Resources Conservation Service (NRCS) Environmental Quality Incentives Program (EQIP) they save money and improve soil quality from the use of “green manure crops” or biofumigants. It is anticipated that the long term outcomes from the use of green manures or biogumigants will also improve the groundwater quality.

Well sampling in 1990 on the Fort Hall Indian Reservation in Idaho indicated health risks from detections of the soil fumigant pesticides 1,2 dichloropropane and ethylene dibromide (EDB). Both pesticides exceeded the Maximum Contaminant Levels (MCLs) that are established by the U.S. Environmental Protection Agency (EPA).

Continued monitoring identified an area approximately 63 square miles in size where groundwater was contaminated with EDB. As of 1996, 109 wells on the Reservation had detectable levels of EDB ranging from 0.02 to 15 ppb (MCL is 0.05 ppb). Other pesticide detections in the early 1990s included dacthal, dinoseb, metribuzin, pentachlorophenol (PCP), and breakdown products of EDB (including trichloropropane and methylene chloride). A combination of factors such as soil type, depth to groundwater, crop production, and pesticide usage contributed to this problem. Potato producers and researchers began working together to solve the groundwater contamination issues.

For years potato producers have been using soil fumigants to control soil borne diseases and weed seed harbored in the soil. Heavy reliance on these soil applied synthetic pesticides in the Fort Hall area has contributed to the past groundwater contamination. It has been discovered that some plants in the *Brassica* family, such as rapeseed, canola, and mustard produce glucosinolates, a compound that is in the roots and shoots of these plants. When these plants are chopped while still green and growing in the field and then incorporated into the soil they produce a compound called isothiocyanate, which is toxic to soil fungi, nematodes, and weed seeds. The isothiocyanate is a biological relative of the synthetic soil fumigant pesticides. These crops are called “green manure crops.” There are other green manure crops that function in a similar way to the *Brassica* crops, namely oilseed radish and sorghum-Sudangrass. The effects of the chemicals produced by these green manure crops on soil borne pests has been called biofumigation.

It has been found that the use of green manures not only have an effect on soil borne pests but also improve soil quality, fertility, and water infiltration. The use of mustard green manure crops in potato cropping systems has been successfully demonstrated on the Fort Hall Reservation. In field trials the potato crop planted after a mustard green manure crop was incorporated performed as well as the standard synthetic soil fumigant pesticide.



Richard Tominaga, a potato producer on the Fort Hall Reservation, discusses his real life experiences with green manure crops at a Fort Hall Reservation field day.



Pacific Northwest Regional Water Quality Coordination Project Partners

Land Grant Universities

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<http://www.uaf.edu/ces/water/>

University Publications:

<http://www.alaska.edu/uaf/ces/publications/>

Idaho

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<http://www.uidaho.edu/wq/wqhome.html>

University Publications:

<http://info.ag.uidaho.edu/Catalog/catalog.html>

Oregon

Oregon State University
Extension Service
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University Publications:

<http://extension.oregonstate.edu/catalog/>

Washington

Washington State University
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Contact Bob Simmons:
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University Publications:

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Water Resource Research Institutes

Water and Environmental Research
Center (Alaska)

<http://www.uaf.edu/water/>

Idaho Water Resources
Research Institute

<http://www.boise.uidaho.edu/>

Institute for Water and
Watersheds (Oregon)

<http://water.oregonstate.edu/>

State of Washington
Water Research Center

<http://www.swwrc.wsu.edu/>

Environmental Protection Agency

EPA, Region 10

The Pacific Northwest

<http://www.epa.gov/r10earth/>

Office of Research and Development,
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<http://www.epa.gov/wed/>

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The Project

Land Grant Universities, Water Research Institutes, and EPA Region 10 have formed a partnership to provide research and education to communities about protecting or restoring the quality of water resources. This partnership is being supported in part by the USDA's Cooperative State Research, Education, and Extension System (CSREES).

Our Goal and Approach

The goal of this Project is to provide leadership for water resources research, education, and outreach to help people, industry, and governments to prevent and solve current and emerging water quality and quantity problems. The approach to achieving this goal is for the Partners to develop a coordinated water quality effort based on, and strengthening, individual state programs.

Our Strengths

The Project promotes regional collaboration by acknowledging existing programs and successful efforts; assisting program gaps; identifying potential issues for cross-agency and private sector collaboration; and developing a clearinghouse of expertise and programs. In addition, the Project establishes or enhances partnerships with federal, state, and local environmental and water resource management agencies, such as by placing a University Liaison within the offices of EPA Region 10.

After work with Potato Growers of Idaho, EPA, Northwest Coalition for Alternatives to Pesticides (NCAP), NRCS, and the University of Idaho, guidelines and criteria for the use of a fall mustard green manure crop was established as an alternative to soil fumigant use. Additionally, Amalgamated Sugar Company, funded by the Western IPM Center, one of the four USDA-CSREES funded IPM Centers, researched the use of oilseed radish for nematode and disease suppression in sugarbeets. As a result of the data generated from these collaborative projects NRCS developed an IPM standard for the use of mustard and oilseed radish biofumigants in 2006. EQIP contracts were awarded cost-share funding for the use of these biofumigants at the payment rate of \$50/acre for potatoes and sugarbeets. Water and soil quality improvement is the goal of implementing biofumigation and for utilizing the NRCS EQIP as incentives to assist growers. Funding from various IPM programs, such as the Western IPM Center (USDA-CSREES), EPA, and NCAP was leveraged to accomplish this work.



National Water Quality Program Areas

The four land grant universities in the Pacific Northwest have aligned our water resource extension and research efforts with eight themes of the USDA's Cooperative State Research, Education, and Extension System.

1. Animal Waste Management
2. Drinking Water and Human Health
3. Environmental Restoration
4. Nutrient and Pesticide Management
5. Pollution Assessment and Prevention
6. Watershed Management
7. Water Conservation and Management
8. Water Policy and Economics

CSREES is the Cooperative States Research, Education, and Extension Service, a sub-agency of the United States Department of Agriculture, and is the federal partner in this water quality program.