



Applying knowledge to improve water quality

Pacific Northwest

Regional Water Program

A Partnership of USDA NIFA
& Land Grant Colleges and Universities

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PNWWATER 167

Protecting Water Quality:

Fertilizer Guidelines for Crop Production

Fertilizers are major inputs on most cropland in the Pacific Northwest. Proper amounts of fertilizers are required for optimum crop yields and efficient crop production; however, excess fertilizer applications can degrade both surface and groundwater quality. Consequently, it is important for farmers in our region to scientifically apply fertilizers to their crops in a manner that results in an excellent economic yield return while also protecting the quality of our region's waters.

Over the past 60 years soil scientists at the University of Alaska, University of Idaho, Oregon State University, and Washington State University have developed over 100 different fertilizer guidelines (called fertilizer guides) for most of the important commercially grown agronomic and horticultural crops in the Pacific Northwest. These nutrient management guidelines are based on relationships between soil tests and crop yield responses. The developed fertilizer guidelines are designed to produce above average crop yields if other factors (such as environment) are not limiting production. Thus, the developed fertilizer guidelines assume the use of sound management practices.



The suggested fertilizer rates will be accurate for a given field provided (1) soil samples are properly taken and represent the area to be fertilized, and (2) the field history information is complete and accurate. Optimal production and economic returns are achieved when the grown crop is managed properly. Inadequate fertilization, poor crop stands, and poor pest control are major contributors to low yields.

Although plants require 17 different elements for growth, only three of these nutrients are widely used in high amounts in the Pacific Northwest. These three large use nutrients include nitrogen (N), phosphorus (P), and sulfur (S). When properly used, fertilizer additions of these three nutrients greatly increase crop yields; however, overuse or misuse can often lead to contamination of surface or groundwater.

Nitrogen is mobile in soils—which means it freely moves in soils. If too much N is applied to soils, or if too much water moves through soils, the excess N can leach below the crop root zone and enter groundwater. High levels of N (nitrates) in groundwater used as drinking water can pose a threat to human health. Approximately, 5 percent of wells in the Pacific Northwest contain unhealthy levels of nitrates. Many of these nitrates are a result over- or mis-applications of commercial N fertilizers. Using the fertilizer guidelines established through research at the region's land grant universities reduces the potential of groundwater contamination with N.

On the other hand, over- or mis-application of phosphorus can result in the degradation of surface water quality. Unlike N, phosphorus does not move in soils—it stays where it is initially placed during fertilization. Phosphorus is readily bound to soil particles near the soil surface. If soil particles move off-site through erosive processes during the season, the phosphorus moves with the soil and eventually enters surface water sources



Pacific Northwest Regional Water Quality Coordination Project Partners

Land Grant Universities

Alaska

Cooperative Extension Service
Contact Fred Sorensen:
907-786-6311

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

University Publications:

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

Idaho

University of Idaho
Cooperative Extension System
Contact Bob Mahler: 208-885-7025

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

University Publications:

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

Oregon

Oregon State University
Extension Service
Contact Mike Gamroth: 541-737-3316

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

University Publications:

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

Washington

Washington State University
WSU Extension
Contact Bob Simmons:

360-427-9670 ext. 690

<http://wawater.wsu.edu/>

University Publications:

<http://pubs.wsu.edu/>

Northwest Indian College
Contact Dan Burns:

360-392-4328

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<http://www.nwic.edu/>

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,
Corvallis Laboratory

<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 National Institute of Food and Agriculture (NIFA).

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.

(lakes, ponds, reservoirs, rivers, streams). The enrichment of surface waters with phosphorus is called eutrophication. The average person sees eutrophication as a green scum on the surface of a water body. This is an algal bloom resulting from phosphorus enrichment. Phosphorus enriched water bodies create a poor environment for fish and other aquatic organisms. We prevent this process by using research-based fertilizer phosphorus recommendations.

Sulfur is the third most often fertilizer applied in the PNW. Sulfur application rates are much lower than either N or P rates. Consequently, very little water resource damage has been linked to mis-applications of S.

In addition to actual N, P, and S application rates, fertilizer guides also provide important information on correct fertilizer placement in the soil, the correct timing of fertilizer applications and the best types of fertilizers to apply.

For more information about fertilizer guides for specific crops please contact the following individuals:

In Washington:

Dr. William L. Pan
Washington State University
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In Idaho:

Dr. Bob Mahler
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In Oregon:

Dr. John M. Hart
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In Alaska:

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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 National Institute of Food and Agriculture.

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

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