2003 Annual Report

Oregon Department of Agriculture

Fertilizer Program

Salem, Oregon

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Oregon Department of Agriculture
Fertilizer Program

635 Capitol Street NE
Salem, Oregon 97301-2532
(503) 986-4635
(503) 986-4735 - Fax

For product registration status, current stop sales, and all things fertilizer, agricultural mineral, agricultural amendment, and lime in Oregon, go to

http://oregon.gov/oda/pest/fertilizer.shtml

Internet Statement Reminder!

On January 1, 2004, the labels of all fertilizer, agricultural mineral, agricultural amendment, and lime products sold in Oregon are required to carry an internet address that leads to the Department's fertilizer program website. This requirement applies to all registered products sold or distributed in Oregon, packaged as well as bulk.

One of the three following statements must be included on the label for registered packaged products, and on the label or bill of lading for registered bulk products:

a. Information regarding the contents and levels of metals in this product is available on the internet at http://www.aapfco.org/metals.htm

b. Information regarding the contents and levels of metals in this product is available at the Oregon Dept of Agriculture internet site: http://oda.state.or.us/fertilizer

c. Information regarding the contents and levels of metals in this product is available on the internet at http://www.regulatory-info-xx.com . Each registrant must substitute a unique alpha numeric identifier for "xx". This statement may be used only if the registrant establishes and maintains the internet site and the internet site meets the following criteria:
  - **i.** There is no advertising or company-specific information on the site: and
  - **ii.** There is a clearly visible, direct hyperlink to the Department's internet site specified in b. above.

The Department is encouraging the use of statement a. The web site is hosted by the Association of American Plant Food Control Officials (AAPFCO) and is currently recognized by the Oregon Department of Agriculture, the Washington State Department of Agriculture, and the California Department of Food and Agriculture, with more states to follow.

Stop Sale, Use, or Removal Orders

Stop Sale, Use, or Removal Orders (SSUROs) are issued by the Department for various violations of Oregon Revised Statute (ORS) 633, the Oregon Fertilizer Control Law. Most commonly, SSUROs are issued when fertilizer, agricultural mineral, agricultural amendment, or lime products are found being distributed in Oregon and are not registered as required. SSUROs may also be issued to products that are mislabeled, or to products that are unregisterable (e.g. fulvic acid, phosphorous acid listed as a source of available phosphate, etc.).

When a SSURO is issued for a particular product, it is effective statewide. The product may not be sold, distributed, or otherwise removed or disposed of without prior written approval from the Department. If a product under SSURO is sold, distributed, or otherwise removed or disposed of without prior written approval from the Department, a civil penalty may be issued.

The products listed below have all been subjects of a SSURO during the calendar year 2003. If no end date is listed, the SSURO is still in effect as of this printing and the product in question is not legal for sale or distribution in Oregon. The most current SSURO status can be found at:

http://oregon.gov/oda/pest/fertilizer.shtml

Company	Product	Reason	Start	End
A.H. Hoffman, Inc. Lancaster, New York	Hydrated Horticultural Lime	Unregistered Product	11-Jun-03	27-Jun-03
Ag Concepts Corporation Bliss, Idaho	5-5-5 Jump Start	Unregistered Product	24-Jul-03	01-Aug-03
	7-28-4 Enhance	Unregistered Product	24-Jul-03	01-Aug-03
	Flora Boost B	Unregistered Product	24-Jul-03	06-Aug-03
Alaska KelpCo Gig Harbor, Washington	Garden G.R.O.G. (Old Label)	Unregistered Product	29-Apr-03	
American Agritech Tempe, Arizona	Power Clone Advanced Formula Rooting Gel	Unregistered Product	24-Jun-03	12-Aug-03
	Power Clone Concentrated Liquid Formula	Unregistered Product	24-Jun-03	12-Aug-03
American Extracts Strathmore, California	Therm-X70	Unregistered Product	13-Oct-03	03-Nov-03
American Hydroponics Arcata, California	Dark Energy	Unregistered Product	29-Apr-03	24-Jun-03
American Minerals, Inc. Dunedin, Florida	Granusol Iron	Unregistered Product	7-May-03	08-May-03
	Granusol Iron	Improperly Labeled	1-Dec-03	16-Dec-03

Company	Product	Reason	Start	End
ASG Consultants, Inc.	Repellex 5-10-5 Bulb Saver	Unregistered Product	4-Jun-03	
Port Moody, British Columbia	Repellex 5-5-5 Root Saver	Unregistered Product	4-Jun-03	
Bella Via, LLC	Metanaturals 1-5-5	Unregistered Product	29-Apr-03	09-May-03
Rohnert Park, California	Metanaturals 3-3-3	Unregistered Product	29-Apr-03	09-May-03
	Metanaturals Organic Calcium	Unregistered Product	29-Apr-03	02-May-03
Bio-Gro, Inc.	Impulse PK 0-20-20	Unregistered Product	6-Jan-03	
Sunnyside, Washington				
Bradfield Industries, Inc.	Corn Gluten Natural Fertilizer	Unregistered Product	4-Jun-03	
Springfield, Missouri				
Chemical Lime Canada, Inc.	High Calcium Hydrated Lime	Unregistered Product	15-Jan-03	26-Feb-03
Langley, British Columbia	Type “N”			
Custom Ag Formulators	Formula 1 0-29-26	Unregisterable Product	17-Sep-03	
Fresno, California				
Earthgro, Inc.	Chicken Manure	Unregistered Product	10-Jul-03	22-Jul-03
Marysville, Ohio	Lawn and Garden Gypsum	Unregistered Product	10-Jul-03	22-Jul-03
EcoEnterprises	EcoBloom 3-35-10	Unregistered Product	29-Apr-03	10-Jul-03
Seattle, Washington	EcoGrow "M" 20-6-12	Unregistered Product	29-Apr-03	10-Jul-03
	EcoBloom "L" 1-8-5	Unregistered Product	24-Jun-03	20-Aug-03
	EcoBloom "L" 3-0-0	Unregistered Product	24-Jun-03	20-Aug-03
	EcoBloom "R" 6-25-17	Unregistered Product	24-Jun-03	20-Aug-03
	EcoGrow "L" 3-4-5	Unregistered Product	24-Jun-03	20-Aug-03
	EcoGrow "L" 5-0-3	Unregistered Product	24-Jun-03	20-Aug-03
	EcoGrow "R" 14-6-17	Unregistered Product	24-Jun-03	20-Aug-03
	EcoGrow "S" 15-7-12	Unregistered Product	24-Jun-03	10-Jul-03
Esco Corporation	Turf Magic Blood Meal 12-0-0	Unregistered Product	6-Oct-03	24-Oct-03
San Ramon, California	Turf Magic Weed & Feed 27-2-4	Unregistered Product	6-Oct-03	4-Oct-03
	Turf Magic Lawn Fertilizer 29-2-4	Unregistered Product	6-Oct-03	24-Oct-03
	Turf Magic Winterizer 18-6-12	Unregistered Product	6-Oct-03	24-Oct-03
	Turf Magic Crabgrass Preventer 25-2-3	Unregistered Product	6-Oct-03	24-Oct-03
	Turf Magic Premium All Purpose Plant Food 16-16-16	Unregistered Product	6-Oct-03	24-Oct-03
General Hydroponics, Inc.	0.2-0-0.2 Chi	Unregistered Product	29-Apr-03	07-Jul-03
Sebastopol, California	Diamond Black	Unregistered Product	29-Apr-03	07-Jul-03
	Diamond Nectar	Unregistered Product	29-Apr-03	07-Jul-03
	Floralicious Bloom	Unregistered Product	29-Apr-03	16-Jul-03
	Floralicious Grow	Unregistered Product	29-Apr-03	07-Jul-03
	PyroSol	Unregistered Product	29-Apr-03	07-Jul-03
	Rare Earth	Unregistered Product	29-Apr-03	
Grotek Manufacturing, Inc.	Pure Fulvic Acid	Unregisterable Product	15-Jan-03	
Langley, British Columbia				

Company	Product	Reason	Start	End
Grower's Choice Wholesale Langley, British Columbia	NutriLife Bio-Cat NutriLife SM-90	Unregistered Product Unregistered Product	24-Jun-03 24-Jun-03	18-Mar-04 04-Sep-03
Growth Products, Ltd. White Plains, New York	Companion 2-3-2	Unregistered Product	1-Oct-03	
Grupo Bioquimico Mexicano, S.A. de C.V. Edinburg, Texas	K-Tionic Nutrient Uptake Promoter	Unregisterable Product	6-Jan-03	
Hydrodynamics Intl. Lansing, Michigan	Nitrozime w/ 400 ppm cytokinins	Improper Labeling	15-Jan-03	
Indoor Gardens Wholesale Ancaster, Ontario	Super Bloom A 2-0-2 Super Veg A 1.5-0-2.6	Unregistered Product Unregistered Product	1-Oct-03 1-Oct-03	
JRV, LLC Madras, Oregon	E-Z- Cal 8-0-0 10% Calcium	Unregistered Product	28-Jan-03	
Liquinox Company Orange, California	0-2-0 with B-1	Unregistered Product	11-Jun-03	18-Jun-03
Nortrace Ltd. Greeley, Colorado	Borosol 10	Unregistered Product	15-Jan-03	30-Jan-03
Olivia's Solutions Calistoga, California	Cloning Solution 0.06-0.13-0.07	Unregistered Product	29-Apr-03	13-May-03
Pace International, LLC Seattle, Washington	Nutra-Phos 0-24-0 Nutra-Phos Cal Zinc 0-24-0 Nutra-Phos Zn-K 0-31-21 Nutra-Spray Zn Seniphos 0-23-0 Sorba Spray Mg 0-10-0 Sorba Spray CaB 3-0-0	Unregistered Product Unregistered Product Unregistered Product Unregistered Product Unregistered Product Unregistered Product Unregistered Product	17-Sep-03 17-Sep-03 17-Sep-03 17-Sep-03 17-Sep-03 17-Sep-03 1-Oct-03	17-Dec-03 17-Dec-03 27-Oct-03 27-Oct-03 27-Oct-03 17-Dec-03 05-Mar-04
Plant Health Care, Inc. Pittsburgh, Pennsylvania	Bio Pak Plus Compete Plus Mycor Tree Injectable PHC for Trees 27-9-9 Yuccah Wetting Agent for IPM Programs	Unregistered Product Unregistered Product Unregistered Product Unregistered Product Unregistered Product	25-Sep-03 25-Sep-03 25-Sep-03 25-Sep-03 25-Sep-03	30-Oct-03 30-Oct-03 27-Oct-03 03-Nov-03 03-Nov-03
Premier Horticulture, Inc. Quakertown, Pennsylvania	Pro-Mix HP Pro-Mix BX Pro Mix for Potting	Unregistered Product Unregistered Product Unregistered Product	4-Nov-03 4-Nov-03 4-Nov-03	17-Dec-03 17-Dec-03 17-Dec-03

Company	Product	Reason	Start	End
Pursell Industries St. Louis, Missouri	All American 16-16-16	Unregistered Product	3-Apr-03	04-Apr-03
	All American 21-0-0	Unregistered Product	3-Apr-03	04-Apr-03
	Colorburst 15-30-15	Unregistered Product	3-Apr-03	04-Apr-03
	Holland Bulb Booster 9-9-6	Unregistered Product	3-Apr-03	04-Apr-03
	Vigoro Azalea, Camellia & Rhododendron 15-7-7	Unregistered Product	3-Apr-03	04-Apr-03
	Vigoro Blood Meal 12-0-0	Unregistered Product	3-Apr-03	04-Apr-03
	Vigoro Bone Meal 1-11-0	Unregistered Product	3-Apr-03	04-Apr-03
	Vigoro MossEx 2-0-0	Unregistered Product	3-Apr-03	04-Apr-03
	Vigoro Rose Food 15-5-13	Unregistered Product	3-Apr-03	04-Apr-03
	Vigoro Tomato & Vegetable 12-10-5	Unregistered Product	3-Apr-03	04-Apr-03
	Vigoro Ultra Iron 6-0-0	Unregistered Product	3-Apr-03	04-Apr-03
	Vigoro Ultra Turf 28-3-3 Weed & Feed	Unregistered Product	3-Apr-03	04-Apr-03
	Vigoro Ultra Turf 29-3-4	Unregistered Product	3-Apr-03	04-Apr-03
	Vigoro Ultra Turf Starter 20-27-5	Unregistered Product	3-Apr-03	04-Apr-03
Rambridge Wholesale Supply Calgary, Alberta	Liquid Gold Fulvic	Unregistered Product	29-Apr-03	
Red Rock Mesa, Arizona	Crop Thruster	Unregistered Product	28-Jan-03	
	LM-32 Colloidal Minerals	Unregistered Product	28-Jan-03	
Reilly Industries, Inc. Wendover, Utah	Reilly Wendover 0-0-60 Potassium Chloride	Unregistered Product	17-Apr-03	20-May-03
Roots, Inc. Salem, Virginia	12-12-12 Fine Grade	Unregistered Product	11-Jul-03	28-Aug-03
	20-2-8 Fairway Formula	Unregistered Product	11-Jul-03	03-Sep-03
Schaeffer Manufacturing St. Louis, Missouri	#235 Wet-Sol 99	Unregistered Product	2-Oct-03	22-Jan-04
Scotts Miracle Gro Marysville, Ohio	All Purpose Plant Food 12-4-8	Unregistered Product	3-Apr-03	04-Apr-03
Stockhausen, Inc. Greensboro, North Carolina	Stockopam	Unregistered Product	28-Jan-03	15-Jul-04
Swiss Farms Products, Inc. Las Vegas, Nevada	Garden Basics Composted Steer Manure	Unregistered Product	10-Jul-03	22-Jul-03
	Garden Basics Top Soil	Unregistered Product	10-Jul-03	22-Jul-03
	Sam's Choice Potting Mix 0.16-0.10-0.10	Unregistered Product	10-Jul-03	22-Jul-03
The Scotts Company Marysville, Ohio	Scotts Potting Soil 0.07-0.01-0.03	Unregistered Product	3-Apr-03	04-Apr-03
	Scotts Potting Soil for Cactus 0-0.01-0	Unregistered Product	3-Apr-03	04-Apr-03
	Scotts Potting Soil 0-0.1-0	Unregistered Product	10-Jul-03	22-Jul-03

Company	Product	Reason	Start	End
Vogel Seed & Fertilizer Jackson, Wisconsin	Spring Valley Weed & Feed 20-3-5	Unregistered Product	11-Jul-03	16-Sep-03
Voluntary Purchasing Groups Bonham, Texas	Compost Maker	Unregistered Product	15-Jan-03	
	Soil Activator	Unregistered Product	15-Jan-03	06-Jul-04
Welcome Harvest Farm, Ltd. Van Anda, British Columbia	Welcome Harvest Farm Bat Guano	Unregistered Product	24-Jun-03	
	Welcome Harvest Farm Fish & Crab Meal	Unregistered Product	24-Jun-03	
	Welcome Harvest Farm Flower Power 4-10-4	Unregistered Product	24-Jun-03	
	Welcome Harvest Farm Langbenite	Unregistered Product	24-Jun-03	
	Welcome Harvest Farm Supergrow Mix 4-4-4	Unregistered Product	24-Jun-03	
Wilbur-Ellis Company Yakima, Washington	Advantage Soil Surfactant	Unregistered Product	6-Jan-03	21-Feb-03

Notice of Violation

A Notice of Violation (NOV) is one of several enforcement options available to the Department to address violations of ORS 633. Prior to the issuance of a NOV, the party involved is fully advised of each incident that is a violation of fertilizer law. The Department offers guidance and assistance to the involved party on how to correct the violation within reasonable timelines. A NOV is typically issued if the party involved has failed to respond to the Department's concerns in a timely and adequate manner. Once the NOV is issued, the party involved may request a contested case hearing before the Director of the Department. If a timely request is not made, the NOV will be entered and recorded by the Department.

A NOV recorded by the Department remains on file for a period of three years. A NOV greatly increases the severity of subsequent enforcement actions (e.g. civil penalty) that may be necessary to address repeat, continuing, or additional violations of ORS 633.

Party Cited	Violation	ORS Section	Disposition
Ag Concepts Corporation Bliss, Idaho	Sell, offer for sale, or distribute an unregistered agricultural mineral product.	633.366(1)(e)	Not Contested. Final Order Issued.
Agrimar Corporation Flowery Branch, Georgia	Sell, offer for sale, or distribute an unregistered fertilizer product.	633.366(1)(e)	Not Contested. Final Order Issued.
Hyponex Corporation Marysville, Ohio	Sell, offer for sale, or distribute unregistered agricultural mineral and agricultural amendment products.	633.366(1)(e)	Not Contested. Final Order Issued.
Pace International, LLC Seattle, Washington	Sell, offer for sale, or distribute unregistered fertilizer and agricultural mineral products.	633.366(1)(e)	Not Contested. Final Order Issued.
Schaeffer Manufacturing Co. St. Louis, Missouri	Sell, offer for sale, or distribute an unregistered agricultural amendment product.	633.366(1)(e)	Not Contested. Final Order Issued.
Stockhausen, Inc. Greensboro, North Carolina	Sell, offer for sale, or distribute an unregistered agricultural amendment product.	633.366(1)(e)	Not Contested. Final Order Issued.
Swiss Farm Products, Inc. Las Vegas, Nevada	Sell, offer for sale, or distribute unregistered agricultural mineral and agricultural amendment products.	633.366(1)(e)	Not Contested. Final Order Issued.
The Scotts Company Marysville, Ohio	Sell, offer for sale, or distribute an unregistered agricultural mineral product.	633.366(1)(e)	Not Contested. Final Order Issued.

Party Cited	Violation	ORS Section	Disposition
Thorpe's Valley Farms Noti, Oregon	Sell, offer for sale, or distribute an unregistered agricultural mineral product.	633.366(1)(e)	Not Contested. Final Order Issued.
Voluntary Purchasing Groups Bonham, Texas	Sell, offer for sale, or distribute unregistered agricultural amendment products.	633.366(1)(e)	Not Contested. Final Order Issued.
Welcome Harvest Farm, Ltd. Van Anda, British Columbia	Sell, offer for sale, or distribute unregistered fertilizer and agricultural amendment products.	633.366(1)(e)	Not Contested. Final Order Issued.

Laboratory Analysis

Official samples of fertilizer, agricultural mineral, agricultural amendment, and lime products are collected by the Department on a continuing basis. Samples are collected to determine if the guaranteed analysis identified on the product label is being satisfied. Routine product sampling provides a two-fold benefit: 1. Consumer protection for buyers; and 2. Identification of potential process problems for blenders and manufacturers.

A sample is considered deficient and in violation if the lab analysis of any guaranteed element is below the stated guarantee by an amount greater than the investigational allowance. The Department uses investigational allowances developed by the Association of American Plant Food Control Officials (AAPFCO). These investigational allowances were officially adopted by the Department as Oregon Administrative Rule (OAR) 603-059-0070 and are available on the fertilizer program's web page:

http://oregon.gov/oda/pest/fertilizer.shtml

Sample analysis results are sorted alphabetically by company name. Company location denotes where the product is registered from, and not necessarily where the sample was collected. Product names marked with an asterisk (*) are custom mixes. These custom mix products do not require registration and were sampled at the location listed.

Company	Product	Element	Label Guarantee	Lab Analysis	Violation?
Ag West Supply	13-6-12	Total Nitrogen (N)	13%	15.3%	No
Rickreall, Oregon		Available Phosphate (P_2O_5)	6%	6.83%	No
		Soluble Potash (K_2O)	12%	12.2%	No
	14-5-3	Total Nitrogen (N)	14%	14.7%	No
		Available Phosphate (P_2O_5)	5%	5.57%	No
		Soluble Potash (K_2O)	13%	12.35%	No
	20-4-8 Turf Blend	**Total Nitrogen (N)**	**20%**	**17.4%**	**Yes**
		Available Phosphate (P_2O_5)	4%	3.37%	No
		Soluble Potash (K_2O)	8%	9.07%	No
Amalgamated Sugar Co.	TASCO NY	Calcium (Ca)	1.0%	7.10%	No
Nyssa, Oregon	Composite Ash	Magnesium (Mg)	0.50%	0.82%	No
		Boron (B)	0.02%	0.025%	No
		Cobalt (Co)	0.0005%	0.0007%	No
	TASCO NY	Calcium (Ca)	1%	3.03%	No
	Scrubber Solids	Sulfur (S)	1%	1%	No
	Nyssa Sugar Lime	Calcium Carbonate ($CaCO_3$)	65%	69.2%	No
		Magnesium Carbonate ($MgCO_3$)	3%	2.76%	No
		Calcium Carbonate Equivalent (CCE)	72%	70%	No
		% Passing 100 Mesh Sieve	60%	84.9%	No
		% Passing 40 Mesh Sieve	80%	90.9%	No
		% Passing 20 Mesh Sieve	90%	94.8%	No
		% Passing 10 Mesh Sieve	100%	97.30%	No
		Moisture	34%	10%	No
		Oregon Lime Score	42	59.2	No

Company	Product	Element	Label Guarantee	Lab Analysis	Violation?
Amalgamated Sugar Co	Nyssa Sugar Lime	Calcium Carbonate ($CaCO_3$)	65%	83.7%	No
Nyssa, Oregon		Magnesium Carbonate ($MgCO_3$)	3%	3.95%	No
		Calcium Carbonate Equivalent (CCE)	72%	83%	No
		% Passing 100 Mesh Sieve	60%	95.8%	No
		% Passing 40 Mesh Sieve	80%	97.7%	No
		% Passing 20 Mesh Sieve	90%	98.2%	No
		% Passing 10 Mesh Sieve	100%	98.4%	No
		Moisture	34%	23.6%	No
		Oregon Lime Score	42	62.2	No
American Minerals	Granusol SE Mix	Boron (B)	3.1%	3.3%	No
Dunedin, Florida		Copper (Cu)	3.1%	3.86%	No
		Iron (Fe)	18.7%	21.3%	No
		Manganese (Mn)	7.8%	8.46%	No
		Zinc (Zn)	**7.8%**	**6.36%**	**Yes**
	Granusol Iron 50%	Iron (Fe)	50%	49.6%	No
The Andersons	25-5-15 Fertilizer with Nutralene	Total Nitrogen (N)	25%	25.2%	No
Maumee, Ohio		Available Phosphate (P_2O_5)	5%	5.27%	No
		Soluble Potash (K_2O)	15%	15.7%	No
		Sulfur (S)	5.1%	6.0%	No
		Copper (Cu)	**0.10%**	**0.079%**	**Yes**
		Iron (Fe)	1.0%	1.04%	No
		Manganese (Mn)	0.10%	0.49%	No
		Zinc (Zn)	0.10%	0.26%	No
	Tee Time 23-2-10 with NS-52 Nitrogen & 5% Iron	Total Nitrogen (N)	23%	22.60%	No
		Available Phosphate (P_2O_5)	2%	2.05%	No
		Soluble Potash (K_2O)	10%	12.7%	No
		Sulfur (S)	16.42%	18.3%	No
		Iron (Fe)	5%	5.4%	No
Becker Underwood Ames, Iowa	Sprint 330	Iron (Fe)	10%	11%	No
Big River Zinc Corp.	Korea Zinc 31% Zinc Sulfate Maxi-Granules	Sulfur (S)	17.5%	18.5%	No
Sauget, Illinois		Zinc (Zn)	31%	30.6%	No
Bio-Oregon	BioGro 7-7-2	Total Nitrogen (N)	7%	6.46%	No
Warrenton, Oregon		Available Phosphate (P_2O_5)	7%	6.4%	No
		Soluble Potash (K_2O)	2%	2.47%	No
		Calcium (Ca)	7%	8.4%	No
		Sulfur (S)	1.5%	2.1%	No

Company	Product	Element	Label Guarantee	Lab Analysis	Violation?
Chemical Lime Salinas, California	Dolomite 65 Ag	Calcium Carbonate ($CaCO_3$)	46%	64.9%	No
		Calcium (Ca)	4%	5%	No
		Magnesium Carbonate ($MgCO_3$)	38.5%	46.9%	No
		Magnesium (Mg)	11.8%	13.5%	No
		Calcium Carbonate Equivalent (CCE)	113%	118%	No
		% Passing 100 Mesh Sieve	95%	98.1%	No
		% Passing 40 Mesh Sieve	97%	100%	No
		% Passing 20 Mesh Sieve	98%	100%	No
		% Passing 10 Mesh Sieve	99%	100%	No
		Moisture	< 2%	0.11%	No
		Oregon Lime Score	108	117.9	No
Crown Technology, Inc. Indianapolis, Indiana	Ferrous Sulfate	Iron (Fe)	20%	20.5%	No
		Sulfur (S)	11%	12.2%	No
Douglas County Farmers Co-op Roseburg, Oregon	DC Sweet 15-8-8-6(S) w/ Micros	Total Nitrogen (N)	15%	16.8%	No
		Available Phosphate (P_2O_5)	**8%**	**6.5%**	**Yes**
		Soluble Potash (K_2O)	8%	9.7%	No
		Sulfur (S)	**6%**	**5.3%**	**Yes**
	DC 16-16-16-6(S)	Total Nitrogen (N)	16%	17.2%	No
		Available Phosphate (P_2O_5)	16%	17.2%	No
		Soluble Potash (K_2O)	16%	15.2%	No
		Sulfur (S)	6%	6.9%	No
Dr. Earth Company Los Angeles, California	4-4-4 Organic 7 All Purpose Fertilizer	Total Nitrogen (N)	4%	4.7%	No
		Available Phosphate (P_2O_5)	4%	4.5%	No
		Soluble Potash (K_2O)	4%	5%	No
		Calcium (Ca)	21.8%	28.5%	No
		Sulfur (S)	1%	0.9%	No
E. B. Stone & Son Suisun, California	E. B. Stone Organics 2-0-3 Alfalfa Meal	Total Nitrogen (N)	2%	2.2%	No
		Soluble Potash (K_2O)	**3%**	**2.4%**	**Yes**
The Fertrell Company Bainbridge, Pennsylvania	Jersey Green Sand 0-0-3	**Soluble Potash (K_2O)**	**3%**	**1.2%**	**Yes**
Fitzmaurice Fertilizer Co. Salem, Oregon	Fitzmaurice 12-4-8-9(S)	Total Nitrogen (N)	12%	13%	No
		Available Phosphate (P_2O_5)	4%	4.5%	No
		Soluble Potash (K_2O)	8%	8.9%	No
		Sulfur (S)	9%	15.2%	No
		Iron (Fe)	10%	9.55%	No
	Fitzmaurice 10-5-10-16(S)	Total Nitrogen (N)	15%	15.9%	No
		Available Phosphate (P_2O_5)	5%	5.3%	No
		Soluble Potash (K2O)	10%	10.2%	No
		Sulfur (S)	16%	16.2%	No
		Magnesium (Mg)	2%	1.83%	No
		Iron (Fe)	**1%**	**0.87%**	**Yes**

Company	Product	Element	Label Guarantee	Lab Analysis	Violation?
Fitzmaurice Fertilizer Co.	Fitzmaurice	Total Nitrogen (N)	16%	19.7%	No
Salem, Oregon	16-16-16-7(S)	Available Phosphate (P_2O_5)	16%	15.4%	No
		Soluble Potash (K_2O)	**16%**	**10.6%**	**Yes**
		Sulfur (S)	7%	7%	No
		Boron (B)	0.25%	0.23%	No
	Fitzmaurice	Total Nitrogen (N)	21%	22.7%	No
	21-7-14-9(S)	Available Phosphate (P_2O_5)	7%	5.6%	No
	Slow Release	Soluble Potash (K_2O)	14.0%	14.1%	No
		Sulfur (S)	9%	9.8%	No
		Iron (Fe)	**2%**	**1.72%**	**Yes**
Fort James Operating Company	RPR Lime	Calcium Carbonate ($CaCO_3$)	22%	35.70%	No
Halsey, Oregon		Magnesium Carbonate ($MgCO_3$)	0.25%	0.71%	No
		Calcium Carbonate Equivalent (CCE)	25%	37%	No
		% Passing 100 Mesh Sieve	0%	0.2%	No
		% Passing 40 Mesh Sieve	0%	0.6%	No
		% Passing 20 Mesh Sieve	0%	4%	No
		% Passing 10 Mesh Sieve	0%	23.9%	No
		Moisture	70%	49.5%	No
		Oregon Lime Score	0	1.6	No
Frit Industries	F-503G	**Boron (B)**	**2.4%**	**1.83%**	**Yes**
Ozark, Alabama		Copper (Cu)	2.4%	2.63%	No
		Iron (Fe)	14.4%	21.9%	No
		Manganese (Mn)	6%	5.66%	No
		Molybdenum (Mo)	0.06%	0.057%	No
		Zinc (Zn)	5.6%	6.21%	No
Gaia Green Products, Ltd.	Glacial Rock Dust	**Calcium (Ca)**	**1.96%**	**0.88%**	**Yes**
Grand Forks, British Columbia		Magnesium (Mg)	0.562%	1%	No
		Cobalt (Co)	**0.00234%**	**0.0015%**	**Yes**
Grow More, Inc.	Seaweed Extract	Total Nitrogen (N)	0.10%	0.21%	No
Gardena, California	Liquid Organic Kelp	Available Phosphate (P_2O_5)	0.10%	0.5%	No
	0.10-0.10-1.5	Soluble Potash (K_2O)	1.5%	4.62%	No
IMC USA, Inc.	K-Mag Premium	Soluble Potash (K_2O)	22%	22.19%	No
Mulberry, Florida	0-0-22	Sulfur (S)	22%	21%	No
		Magnesium (Mg)	10.8%	10.7%	No
Ironite Products Company	Ironite 1-0-0	Total Nitrogen (N)	1%	3%	No
Humboldt, Arizona		Calcium (Ca)	2.5%	3.42%	No
		Magnesium (Mg)	1%	2.01%	No
		Sulfur (S)	4.5%	4.5%	No
		Iron (Fe)	4.5%	4.76%	No
		Manganese (Mn)	0.07%	0.083%	No
		Zinc (Zn)	0.45%	0.98%	No
J. R Simplot Company	16-20-0 Ammonium	Total Nitrogen (N)	16%	16%	No
Lathrop, California	Phosphate Sulfate	Available Phosphate (P_2O_5)	20%	20.9%	No
		Sulfur (S)	13%	14.4%	No

Company	Product	Element	Label Guarantee	Lab Analysis	Violation?
J. R Simplot Company Lathrop, California	Custom Blend * 21-4-9 Mini	Total Nitrogen (N)	21%	21.6%	No
		Available Phosphate (P_2O_5)	4%	4.03%	No
		Soluble Potash (K_2O)	9%	10.7%	No
		Sulfur (S)	12.4%	14%	No
		Iron (Fe)	4%	5.1%	No
Lesco, Inc. Strongsville, Ohio	Poly Plus 39-0-0 Polymer Coated Sulfur Coated Urea	Total Nitrogen (N)	39%	39.9%	No
		Sulfur (S)	12%	14.6%	No
		Chlorine (Cl)	<2%	0.1%	No
Marion Ag Service St. Paul, Oregon	Professional Turf 23-2-22-10(S)	Total Nitrogen (N)	23%	23.5%	No
		Available Phosphate (P_2O_5)	2%	3.2%	No
		Soluble Potash (K_2O)	22%	24.0%	No
		Sulfur (S)	3%	3.1%	No
Milwaukee Metro Sewerage Milwaukee, Wisconsin	Milorganite Greens Grade 6-2-0 with 4% Iron	Total Nitrogen (N)	6%	6.2%	No
		Available Phosphate (P_2O_5)	2%	3.54%	No
		Calcium (Ca)	1.5%	2%	No
		Chlorine (Cl)	<1%	0.39%	No
Monterey Chemical Company Fresno, California	Monterey Liquid Zinc 10%	Sulfur (S)	4%	5.9%	No
		Zinc (Zn)	10%	11.1%	No
	MonoPlex Plus 2	Sulfur (S)	8%	7.5%	No
		Boron (B)	1.5%	1.51%	No
		Copper (Cu)	1.5%	1.42%	No
		Manganese (Mn)	3%	3.13%	No
		Zinc (Zn)	6%	6.06%	No
Nu-Gro Technologies, Inc. Grand Rapids, Michigan	30.8-0-0 Coarse Grade IBDU	Total Nitrogen (N)	30.8%	30%	No
Nutri Ag, Ltd. Toronto, Ontario	Spraybor	Boron (B)	16.5%	16.7%	No
Pace International, LLC Seattle, Washington	Nutra-Phos Zn-K 0-31-21	Available Phosphate (P_2O_5)	31%	32%	No
		Soluble Potash (K2O)	21%	21.8%	No
		Zinc (Zn)	31%	31.3%	No
Pacific Calcium Tonasket, Washington	Montana Natural Rock Phosphate 0-3-0	**Available Phosphate (P_2O_5)**	**3%**	**1.9%**	**Yes**
		Calcium (Ca)	29%	28.4%	No
PCS Sales (USA), Inc. Northbrook, Illinois	Muriate of Potash 0-0-62	Soluble Potash (K_2O)	62%	61.93%	No
	Muriate of Potash 0-0-60	Soluble Potash (K_2O)	60%	61.7%	No
Phelps Dodge Refining Corp. El Paso, Texas	Triangle Brand Copper Sulfate Crystal	Copper (Cu)	25.3%	25.2%	No

Company	Product	Element	Label Guarantee	Lab Analysis	Violation?
RSA MicroTech, LLC	Manganese Sulfate	Sulfur (S)	18.5%	19.1%	No
Burlington, Washington	Monohydrate	Manganese (Mn)	32%	31.7%	No
Rod McLellan Company	Whitney Farms 100%	Total Nitrogen (N)	8%	8.5%	No
Independence, Oregon	Natural Lawn Food	Available Phosphate (P_2O_5)	2%	1.9%	No
	8-2-4	Soluble Potash (K_2O)	4%	3.8%	No
		Calcium (Ca)	3%	6.14%	No
Scotts-Sierra Hort Products	Osmocote 18-6-12	Total Nitrogen (N)	18%	18.6%	No
Marysville, Ohio		Available Phosphate (P_2O_5)	6%	6.71%	No
		Soluble Potash (K_2O)	12%	12.2%	No
Simplot Grower Solutions	Simplot 16-16-16	Total Nitrogen (N)	16%	15.4%	No
Independence, Oregon		Available Phosphate (P_2O_5)	16%	16.5%	No
		Soluble Potash (K_2O)	**16%**	**15.2%**	**Yes**
		Sulfur (S)	6.66%	6.8%	No
	Simplot 10-20-20	Total Nitrogen (N)	10%	11.7%	No
		Available Phosphate (P_2O_5)	**20%**	**16.1%**	**Yes**
		Soluble Potash (K_2O)	20%	19.7%	No
		Sulfur (S)	**11.41%**	**8.2%**	**Yes**
Tetra Micronutrients	Zink-Gro Maxi-Granular	Sulfur (S)	17.5%	17.6%	No
The Woodlands, Texas	35.5% Zinc Sulfate	Zinc (Zn)	35.5%	35.3%	No
	Monohydrate				
United Horticultural Supply	UAP 0-3-1 Sunshine	Available Phosphate (P_2O_5)	3%	4%	No
Dayton, Oregon	Mix Without Nitroform	Soluble Potash (K_2O)	1%	2.4%	No
		Calcium (Ca)	22.7%	26%	No
		Sulfur (S)	1%	1.3%	No
		Boron (B)	0.02%	0.028%	No
		Iron (Fe)	0.55%	0.9%	No
	UAP 16-16-16 TE	Total Nitrogen (N)	16%	16%	No
		Available Phosphate (P_2O_5)	16%	16.4%	No
		Soluble Potash (K_2O)	16%	18.5%	No
		Sulfur (S)	6%	5.5%	No
		Boron (B)	0.03%	0.031%	No
		Iron (Fe)	0.18%	0.37%	No
		Zinc (Zn)	0.07%	0.0907%	No
	Woodace 18-4-9	**Total Nitrogen (N)**	**18.0%**	**16.6%**	**Yes**
	IBDU	Ammoniacal Nitrogen (N)	4.6%	5.03%	No
		Water Insoluble Nitrogen (N)	**12.31%**	**11%**	**Yes**
		Available Phosphate (P_2O_5)	4%	4.08%	No
		Soluble Potash (K_2O)	9%	9%	No
		Magnesium (Mg)	2%	2.31%	No
		Sulfur (S)	10.3%	11.2%	No
		Boron (B)	0.031%	0.0273%	No
		Iron (Fe)	0.18%	0.267%	No
		Manganese (Mn)	0.078%	0.108%	No
		Molybdenum (Mo)	0.0007%	0.00039%	No
		Zinc (Zn)	0.073%	0.0673%	No

Company	Product	Element	Label Guarantee	Lab Analysis	Violation?
U. S. Borax Valencia, California	Granubor 15% Boron	Boron (B)	15%	15.2%	No
Western Farm Service Cornelius, Oregon	32-0-17 Custom Mix *	Total Nitrogen (N)	32%	32.2%	No
		Soluble Potash (K_2O)	17%	16.7%	No
		Boron (B)	0.25%	0.29%	No
	35-0-10 Custom Mix *	Total Nitrogen (N)	35%	37.9%	No
		Soluble Potash (K_2O)	**10%**	**7.2%**	**Yes**
		Sulfur (S)	2%	2.3%	No
		Boron (B)	0.2%	0.23%	No
Western Farm Service Rickreall, Oregon	29-0-16-3(S) Custom * Filbert Blend	Total Nitrogen (N)	29%	31.1%	No
		Soluble Potash (K_2O)	16%	15.37%	No
		Sulfur (S)	3%	3.8%	No
Western Farm Service Tangent, Oregon	First Choice 9-19-19-6(S)	Total Nitrogen (N)	9%	9.1%	No
		Available Phosphate (P_2O_5)	19%	18.3%	No
		Soluble Potash (K_2O)	19%	20.8%	No
		Sulfur (S)	6%	6.8%	No
		Iron (Fe)	2.7%	2.7%	No
	First Choice 12-4-8-10(S)	Total Nitrogen (N)	12%	13%	No
		Available Phosphate (P_2O_5)	4%	4.18%	No
		Soluble Potash (K_2O)	8%	7.88%	No
		Sulfur (S)	10%	9.9%	No
		Iron (Fe)	15%	15.8%	No
	First Choice 15-10-10-3.6(S)	Total Nitrogen (N)	15%	14.5%	No
		Available Phosphate (P_2O_5)	10%	11%	No
		Soluble Potash (K2O)	10%	11.3%	No
		Magnesium (Mg)	1%	1.21%	No
		Sulfur (S)	3.6%	3.6%	No
		Boron (B)	0.1%	0.25%	No
		Copper (Cu)	**0.1%**	**0.033%**	**Yes**
		Iron (Fe)	1%	1.21%	No
	First Choice 18.8-9.4-9.4-7.5(S)	**Total Nitrogen (N)**	**18.8%**	**17%**	**Yes**
		Available Phosphate (P_2O_5)	**9.4%**	**8.1%**	**Yes**
		Soluble Potash (K_2O)	9.4%	9.8%	No
		Sulfur (S)	7.5%	9.5%	No
		Magnesium (Mg)	3.76%	4.13%	No
		Iron (Fe)	1.82%	2.1%	No
	Professional Turf 21-7-14-10(S)	Total Nitrogen (N)	21%	21.4%	No
		Available Phosphate (P_2O_5)	7%	7.0%	No
		Soluble Potash (K_2O)	14%	15.1%	No
		Sulfur (S)	10%	10.5%	No
	First Choice 28-5-7-10(S)	**Total Nitrogen (N)**	**28%**	**26.5%**	**Yes**
		Available Phosphate (P_2O_5)	5%	5.87%	No
		Soluble Potash (K_2O)	7%	8.48%	No
		Sulfur (S)	**10%**	**6.3%**	**Yes**
		Iron (Fe)	3%	4%	No

Company	Product	Element	Label Guarantee	Lab Analysis	Violation?
Wilbur-Ellis Company	40-0-0-6(S) *	Total Nitrogen (N)	40%	39.5%	No
Jefferson, Oregon	Custom Mix	Sulfur (S)	6%	7.2%	No
Wilbur-Ellis Company	25-3-10 Wil-Gro	**Total Nitrogen (N)**	**25%**	**22.6%**	**Yes**
Yakima, Washington	Five Iron	Available Phosphate (P_2O_5)	3%	3.2%	No
		Soluble Potash (K_2O)	10%	12.2%	No
		Sulfur (S)	5%	6.2%	No
		Iron (Fe)	5%	6.78%	No
	10-20-20 Wil-Gro	Total Nitrogen (N)	10%	11.4%	No
	Pro Start	Available Phosphate (P_2O_5)	20%	22.2%	No
		Soluble Potash (K_2O)	**20%**	**16.1%**	**Yes**
		Sulfur (S)	6%	8.3%	No
	18-6-12 Wil-Gro	Total Nitrogen (N)	18%	20.9%	No
	Ornamental Topdress	Available Phosphate (P_2O_5)	6%	5.7%	No
		Soluble Potash (K_2O)	**12%**	**10%**	**Yes**
		Magnesium (Mg)	1.32%	1.16%	No
		Sulfur (S)	**11%**	**7.9%**	**Yes**
		Iron (Fe)	**2%**	**1.19%**	**Yes**
Wilco	16-18-22 Wil Grow	Total Nitrogen (N)	16%	16%	No
Mt. Angel, Oregon	Water Soluble	Available Phosphate (P_2O_5)	18%	18.5%	No
	Fertilizer	Soluble Potash (K_2O)	22%	23.5%	No
		Sulfur (S)	2%	2.4%	No
		Boron (B)	0.05%	0.049%	No
		Copper (Cu)	0.1%	0.091%	No
		Iron (Fe)	0.1%	0.1%	No
		Manganese (Mn)	0.1%	0.124%	No
		Molybdenum (Mo)	0.0005%	0.0045%	No
		Zinc (Zn)	1%	1.24%	No
	20-6-10 Valley Choice	Total Nitrogen (N)	20%	20.6%	No
	Extra Green Lawn	Available Phosphate (P_2O_5)	6%	5.6%	No
	Food	Soluble Potash (K_2O)	10%	11%	No
		Magnesium (Mg)	1%	1.25%	No
		Sulfur (S)	9%	9.7%	No
		Iron (Fe)	2%	1.86%	No
		Zinc (Zn)	0.5%	0.72%	No
	Wilco 20-10-15	Total Nitrogen (N)	20%	20.8%	No
		Available Phosphate (P_2O_5)	10%	10.6%	No
		Soluble Potash (K2O)	15%	16.2%	No
	Wilco 20-12-8-8(S)	**Total Nitrogen (N)**	**20%**	**18.8%**	**Yes**
		Available Phosphate (P_2O_5)	12%	14.1%	No
		Soluble Potash (K_2O)	8%	8.7%	No
		Magnesium (Mg)	1%	1.38%	No
		Sulfur (S)	8%	10.9%	No
		Boron (B)	0.02%	0.03%	No
		Copper (Cu)	0.09%	0.107%	No
		Iron (Fe)	0.7%	1.02%	No
		Zinc (Zn)	0.06%	0.2%	No
	Wilco 31-2-4-3(Fe)	Total Nitrogen (N)	31%	30.9%	No
		Available Phosphate (P_2O_5)	2%	2.5%	No
		Soluble Potash (K_2O)	4%	4.7%	No
		Iron (Fe)	3%	3.87%	No

Company	Product	Element	Label Guarantee	Lab Analysis	Violation?
Woodburn Fertilizer	Oregon Premix	Total Nitrogen (N)	19.67%	20%	No
Woodburn, Oregon		Available Phosphate (P_2O_5)	8.3%	8.7%	No
		Calcium (Ca)	**7.38%**	**5%**	**Yes**
		Sulfur (S)	2.58%	5.5%	No
		Boron (B)	0.02%	0.033%	No
		Copper (Cu)	0.08%	0.109%	No
		Iron (Fe)	5.72%	7.83%	No

Tonnage

Data on the tonnage of fertilizer, agricultural mineral, agricultural amendment, and lime products sold or distributed into Oregon is collected by the Department twice a year. ORS 633 allows for the publication of this data so long as no confidential business information is disclosed. The primary audience of this data is Oregon dealers and the manufacturers of registered products. Tonnage data is also provided to AAPFCO to facilitate the publication of *Commercial Fertilizers*, an annual, nationwide compilation of state fertilizer tonnage data.

Fertilizer, Agricultural Mineral, Agricultural Amendment, and Lime Material Tonnage Sold or Distributed into Oregon January 1, 2002 - December 31, 2002 January 1, 2003 - December 31, 2003

Material	Grade	2002 Tons	2003 Tons
Liming Materials			
Calcium Hydroxide (Hydrate)		1,004	173
Standard Dolomite		46,258	38,346
Standard Calcite		113,002	129,290
By-product Lime		247,966	239,275
Liming Materials - Other Analysis		3,336	6
Total Liming Materials		**411,566**	**407,090**
Agricultural Minerals			
Boron		1,947	2,156
Calcium		1,920	911
Copper		98	116
Gypsum		27,440	23,351
Iron		3,302	3,506
Magnesium		1,149	574
Manganese		159	166
Molybdenum		6	2
Sulfur		3,986	3,534
Trace Combinations		602	9,074
Zinc		1,696	1,674
Total Agricultural Minerals		**42,305**	**45,064**
Organic Materials			
Bone Meal, Steamed		694	487
Blood Meal		166	272
Compost		9,865	11,342
Cotton Seed Meal		199	160
Fish Scrap		975	1,546
Kelp		96	77
Poultry Manure		99	895
Total Organic Materials		**12,094**	**14,779**

Material	Grade	2002 Tons	2003 Tons
Nitrogen Materials			
Anhydrous Ammonia	82-0-0	23,751	25,827
Aqua Ammonia	20-0-0	2,680	2,695
Ammonium Nitrate	34-0-0	28,449	30,517
Ammonium Nitrate Solution	20-0-0	1,023	893
Ammonium Nitrate-Sulfate	30-0-0	93	21
Ammonium Polysulfide	20-0-0	55	3,378
Ammonium Sulfate	21-0-0	110,024	106,556
Ammonium Sulfate Solution	6-0-0	1,398	2,642
Ammonium Thiosulfate	12-0-0	13,510	12,854
Calcium Ammonium Nitrate	17-0-0	1,057	749
Calcium Nitrate	15-0-0	6,333	5,775
Calcium Nitrate-Urea	33.8-0-0	0	448
Nitric Acid	15-0-0	819	940
Nitrogen Solutions 28%- 32%		99,785	101,614
Sodium Nitrate	16-0-0	100	55
Sulfur Coated Urea	36-0-0	1,170	641
Polymer Coated Urea	42-0-0	286	322
Urea	46-0-0	289,218	170,253
Urea Solution	20-0-0	0	24
Urea Formaldehydes		5,294	3,993
Nitrogen Materials - Other Analysis		10,611	4,515
Total Nitrogen Materials		**595,657**	**474,712**
Phosphate Materials			
Ammonium Metaphosphate	12-51-0	30	27
Ammonium Phosphate	11-48-0	0	269
Diammonium Phosphate	18-46-0	1,328	1,474
Ammonium Phosphate Sulfate	16-20-0	44,842	45,762
Monoammonium Phosphate	11-52-0	53,336	55,976
Rock Phosphate	0-3-0	1,402	1,028
Phosphoric Acid	0-54-0	237	134
Liquid Ammonium Polyphosphate	10-34-0	3,589	6,384
Superphosphate, Enriched	0-23-0	7	16
Superphosphate, Triple	0-46-0	911	1,893
Superphosphoric Acid	0-68-0	8,351	21,674
Phosphate Materials - Other Analysis		14,503	5,584
Total Phosphate Materials		**128,536**	**140,221**
Potash Materials			
Potash Suspensions		207	269
Potassium Hydroxide		0	284
Muriate of Potash 60%	0-0-60	52,065	58,166
Muriate of Potash 62%	0-0-62	4,320	5,302
Potassium-Magnesium Sulfate	0-0-22	16,928	16,504
Potassium-Metaphosphate	0-55-37	42	11
Potassium-Nitrate	14-0-44	321	472
Potassium Sulfate	0-0-50	56,472	48,831
Potash Materials - Other Analysis		4,826	961
Total Potash Materials		**135,181**	**130,800**

Material	Grade	2002 Tons	2003 Tons
Agricultural Amendments		53,393	16,645
Lawn & Garden		36,791	60,053
Fertilizer Products - Other Analysis		10,704	19,488
Total Oregon Tonnage		**1,426,227**	**1,308,852**

Fertilizer Research

House Bill 3515, passed during the 1989 Oregon Legislative Session, amended ORS 633.460 and directed the Department to collect monies to fund grants for research and development related to the interaction of pesticides or fertilizers and groundwater. Grant funding was generated through an increase in inspection fees. House Bill 2509, passed during the 1997 Oregon Legislative Session, refined ORS 633.460 by placing a cap on inspection fees, and limiting the amount of collected inspection fees that could be used for grant funding. House Bill 3815, passed during the 2001 Oregon Legislative Session, eliminated pesticide projects from funding, but opened up funding opportunities for projects focusing on the interaction of fertilizers with surface water. Further, House Bill 3815 also provided for the creation of a Fertilizer Research Committee, comprised of three members of the fertilizer industry, two members of the public, one member from Oregon State University, and one member from the Department. The Fertilizer Research Committee advises the Director of the Department on the funding of grants.

To date, $1,814,469 has been generated to fund 86 projects dealing with a wide variety of crops throughout the state. Selected projects can be viewed online at:

http://oregon.gov/oda/pest/fertilizer.shtml

Excerpted proposals for the three currently funded projects are shown below. Full project proposals and updates can be viewed at the above website.

Project *Validating Modeling Parameters for Risk Assessment of Metals in Fertilizers*

Principle Investigator Larry Curtis
Environmental & Molecular Toxicology Department
Oregon State University

Funded Amount $19,731.00

Project Term September 9, 2003 - September 30, 2005

Overview The Oregon Department of Agriculture (ODA) set standards for arsenic, cadmium, lead, mercury, and nickel concentrations in fertilizers and related products in 2003. Development of these standards was largely based on critical evaluation of previously-conducted human health risk assessments. These risk assessments evaluated multiple exposure pathways for farm workers and farm families, including children. These groups were considered as those with highest exposure potential and therefore at most risk. Accumulation of metals in crops consumed in high quantities by farm families and direct consumption of soil were identified as pathways for maximum potential exposures. Estimated soil concentrations of arsenic, cadmium, lead, mercury, and nickel after 50 years of product applications and soil lead concentration after 200 years of product applications were used for exposure pathway analyses. Therefore, estimated soil accumulation rates for these metals over time were critical determinants of outcomes for exposure modeling.

Aside from amount applied, estimated tendencies of metals to leach from soils to groundwater and or surface water were major determinants of outcomes for soil accumulation modeling. The ratio of metal concentration in soil particles divided by that in soil water (distribution coefficient, K_d) was the modeling parameter that represented tendency for leaching of each metal. K_d values employed for risk assessments were derived from two literatures reviews. The work reviewed in these studies clearly demonstrated K_ds for metals were not constants but varied greatly depending on soil chemistry, especially pH and organic matter content. Metals were consistently more water soluble and prone to leaching in acid soils (lower K_d). Increased organic matter content elevated the number of metal binding sites in soil and increased K_d. The K_d for a given metal in a soil was also dependent the total metal concentration. As metal binding sites saturated, K_d decreased. Since K_d values were determined in the laboratory, differences in methods employed also contributed to variability. K_ds were most often estimated with soil columns or stirred flow reactors. Strawn and Sparks demonstrated equilibrium conditions assumed for such methods were not achieved under standard laboratory conditions. Taken together, complex environmental chemistry and methodological limitations were expected to produce uncertainty in K_d estimates. The great disparity between K_d estimates was problematic. Estimates for arsenic varied about 1000-fold, those for cadmium at least 100-fold, and those for lead at least 20-fold. Selection for K_ds for risk assessment was therefore a huge source of uncertainty and controversy. The major goal of this project is to “ground truth” estimates of metal accumulation rates in agricultural soils with the K_d estimates incorporated into risk assessment modeling. This involves data analyses for arsenic, cadmium, lead, mercury, and nickel concentrations in Oregon soils collected in other projects ODA funds in response to the “2003 Ground and Surface Water Research Grants.” Specifically, proposals that determine soil metal concentrations over time with or without fertilizer applications are of special value for validation of K_ds. Measurements in ground and surface waters provide additional insight into metal leaching/mobility and potential impacts on freshwater resources. Determinations of metal concentrations in crops grown in soils of known metal concentrations provide a means for “grounding truthing” plant uptake factor (PUF) estimates. It is important to recognize that substantial dilution of metals in fertilizers occurs when they are dispersed in the tilled layer of agricultural soils. Years of monitoring after the current funding cycle is clearly necessary. Major objectives of the work we propose are to establish a firm background for this monitoring program and provide ODA the computer software necessary to appropriately analyze data deriving from it.

The potential for crops to accumulate arsenic, cadmium, lead, mercury or nickel from soils were represented by PUFs in risk assessment modeling. Measurements for PUFs varied about 10-fold for a particular metal. Much of this was due to differences in metal accumulation for different plant species. The impact of uncertainty about PUFs was much less problematic for risk assessment than uncertainty over K_ds. None-the-less a secondary goal of this project is to validate PUFs for crops grown on agricultural soils with known fertilizer product applications.

Risk assessments for arsenic, cadmium, lead, mercury, and nickel require assembly of data sets on the toxicology of these metals in addition to environmental chemistry used for exposure assessment. The project’s final goal is to review recent literature on environmental chemistry, general toxicology, and ecotoxicology of these metals. This provides valuable context for examining assumptions inherent to risk assessment. It also provides a basis for evaluation of groundwater and surface water data for sites associated with fertilizer product applications. There are allowable levels for these metals in drinking water for human health and surface water for protection of aquatic life. These provide context necessary for interpretation new data collected over the next three years. If metal concentrations in sediments from surface waters adjacent to fertilized agricultural land are provided by other projects, these will be compared to available USEPA sediment quality criteria.

Project *Complete Characterization of Parameters Used in Risk Assessment Models for Heavy Metal Transport Associated with Fertilizer Applications in Oregon*

Principle Investigators William Fish
Departments of Civil & Environmental Engineering and Environmental Sciences & Resources
Portland State University

Gwynn Johnson
Departments of Civil & Environmental Engineering and Geology
Portland State University

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Overview Fertilizers, agricultural minerals, agricultural amendments, and lime products may contain toxic metal contaminants that can adversely affect human health and the well-being of livestock and natural ecosystems. The levels of heavy metals in fertilizers and related materials are thus subject to regulation by the Oregon Department of Agriculture. Regulators need to balance the benefits of economical fertilizers with the risks posed by excessive levels of metals in these essential products. Balancing benefits and risks can be achieved with risk-based standards. Human health risk assessments are a key part of creating reasonable and prudent regulations for permissible levels of metals in fertilizers.

Assessing the risks to humans from exposure to fertilizer-derived metals requires that we understand the pathways of exposure (e.g. via drinking water, food crops, or incidental soil ingestion/inhalation). Predicting these pathways, in turn, requires an accurate knowledge of the concentration of metals in soil porewater and in soil solids. It is not feasible to directly measure these concentrations in the nearly infinite variety of field conditions, so we must base our risk assessments on solute-transport models that accurately characterize the physical and chemical mechanisms affecting metal behavior in soil.

Risk assessments for fertilizer-derived metals have, of necessity, used a simplistic model of metal behavior in soil that assumes that metals reach an equilibrium state in which they partition between soil solid and soil porewater. This model relies on a single-value partition or distribution coefficient (K_d) for each metal, which is used to predict the concentration of metals in the porewater (which can be taken up by plants or leach into groundwater and surface water) and the metals associated with the soil solids (which potentially result in the long term accumulation of metals in the soil).

The equilibrium partition approach is used because it is easily integrated into various chemical models. Additionally, it is the only practical model for which sufficient data are available for a critical review of published K_d data. However, it is widely recognized that the equilibrium partition model is highly unreliable for predicting metal transport and fate for two main reasons: 1) the available K_d data for a given metal can vary by two to three orders of magnitude, resulting in hundredfold to thousand fold uncertainty in the human health risk estimates, and 2) the underlying premise of a static soil-water equilibrium is false because metal behavior in soils is a complex, variable, and highly dynamic set of processes. There is thus a critical need to improve our understanding of the transport and fate of fertilizer-derived metals in agricultural soils. Although studies in recent years have greatly expanded the base of knowledge for such systems, much of the work has focused on metals derived from hazardous wastes or sewage sludge application. Also, there is very little available information pertinent to metal behavior in Oregon soils under a variety of agricultural practices and climate conditions. Thus it is difficult or impossible to transfer the results of those studies to the specific problem of metals leaching from fertilizers as they are used in Oregon agriculture. There is an urgent need for a detailed yet practical study of key heavy metals in the fertilizer-soil systems that are relevant to Oregon applications.

Our overall goal is to create a model of metal solubility, transport, and accumulation in agricultural soils that requires a minimal number of measured physical and chemical parameters, yet represents a diversity of Oregon soil types and agricultural practices. The model and its supporting data will be used to: 1) assess the leachability and availability of soluble metals; 2) characterize the potential for long-term buildup of metals in soils; and 3) identify the rate at which accumulated metals either leach from the soil or are sequestered via an “aging” process. The specific objectives of this research project are to:

1. Collect intact “undisturbed” core samples along with corresponding conventional grab samples of soils from trial sites located in Oregon, coordinating with K. Anderson (OSU) and representatives from ODA.
2. Characterize the physical properties of undisturbed soils using advanced column techniques that reveal the role of natural heterogeneity in soil structure and chemistry.
3. Analyze soil grab samples for conventional physical/chemical characteristics such as porosity, mineralogy, cation exchange capacity, organic carbon content and extractable metal oxides.
4. Identify the metal sorption/desorption properties of the various soil samples over a wide range of metal concentrations, pH, and for relevant (target) toxic metals.
5. Characterize the importance of rate-limited mass-transfer processes of sorption and desorption with a special emphasis on the aging associated with long-term heavy metal loaded soils that may potentially effect the eventual leaching of metals.
6. Create a practical model of metal-soil interactions based on parameters obtainable from conventional soil characterization methods.
7. Verify the diagnostic utility of the model with column studies of undisturbed cores that bridge the gap between conventional lab studies and actual behavior of metals in the field.

Project *Distribution and Fate of Background and Bioavailable Metals in Oregon Agricultural Soils, Plants and Waters*

Principle Investigator Kim A. Anderson
Environmental & Molecular Toxicology Department
Oregon State University

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Overview

Background levels of metals in Oregon soils that receive fertilizer treatments are not well understood. The effects of fertilizer use and the long-term effects on biota uptake and on surface and ground waters are also not well understood for Oregon soils. In addition, to understanding background levels, bioaccumulation, bioavailability and partitioning are keys to truly understanding risk. Bioavailability of metals is the accessibility for biological assimilation and possible toxicity. Federal and state regulatory agencies typically rely on analytical methods that entail vigorous extraction of matrices with strong acids. The relevancy of such methods to the toxicity is often not considered, thus decisions are based on data that is often not relevant for prediction of potential exposures and risk. The evidence is compelling that the quantities recovered by vigorous extraction/digestion fail to predict bioavailability of the compounds. Regulatory agencies have recognized the importance of determining bioavailable versus total contaminant concentration**;** US EPA has allowed certain regions to develop site specific criteria based on bioavailable levels of priority pollutants.

Health/Risk/Fate - *Depends on Chemical form*: For chemical contaminants, aquatic toxicity data, water quality criteria and threshold limit values are based on dissolved concentrations and not total metal levels. For example, a study of copper distribution and water effects ratios were recently performed under the auspices of EPA Region 2 for New York/New Jersey. Based on this work (i.e. bioavailable copper) revised criteria were proposed and adopted. The modified criteria saved costly remediation efforts in NY/NJ. Presented below one can see how different conceptual approaches can lead to significantly different estimates of exposure. To efficiently generate quantitative exposure estimates and to accurately characterize risks posed by metals, bioavailability needs to be considered as early as possible in the risk assessment. However, the assessment of hazards posed by contaminated soils has been hampered by the lack of simple realistic procedures that assess the rates and extent to which metals can be released from soil particles and supplied to biota.

Background on Bioavailable Metal Methods:

DGT (diffusive gradients thinfilms) are simple, precision devices that accumulate dissolved substances in a controlled fashion. Conventional analyses back in the laboratory provide the in-situ concentrations at the time of deployment. The device uses a layer of Chelex resin impregnated in a hydrogel to accumulate the metals. The resin-layer is overlain by a diffusive layer of hydrogel and a filter. Ions have to diffuse through the filter and diffusive layer to reach the resin layer. The concentrations of metal ions in the sediment adjacent to the device are lowered. This can induce supply of metal ions from the soil phase to solution in the layers of sediment near the device. The total metal accumulated during the deployment is measured. DGT measures directly the mean flux of labile species to the device during the deployment. This can be interpreted directly as the mean concentration of labile metal at the interface between the device surface and the sediment, during the deployment. For the situation where supply from soil particles to solution is rapid, this interfacial concentration is the same as the concentration of metal in bulk pore-water. For a given device and deployment time, the interfacial concentration can be related directly to the effective concentration of labile metal, C_E. C_E represents as a concentration the supply of metal to any sink, be it DGT or an organism, that comes from both diffusion in solution and release from the soil phase.

Relevance to sediment quality regulations

The effective concentration, C_E, measured by DGT has been shown to correlate very well with uptake by biota. DGT mimics the main mechanism of uptake by lowering the concentration locally and inducing diffusive supply and release from the solid phase. Although this is a dynamic measurement that depends on both the rate of transport and the rate of release, it can be used to provide an effective concentration, C_E. C_E is a measure of what the solution concentration would have to be to produce the observed accumulation of metal if there was no supply from the solid phase. C_E may therefore be related through water quality toxicity tests to a quality standard. C_E is measured directly and simply. It automatically accounts for all sediment properties, including pH and organic matter content.

Metals in Soils and Plant Uptake

The first application of DGT in soils showed that in soils where sludge had been applied, Cd and Zn were present in two separate pools with different kinetic availabilities. A follow-up study of plant uptake of Cu, Cd, Co, Zn, Pb and Ni at different moisture contents showed that the change in plant uptake with moisture content was more closely related to the observed change in DGT uptake than to soil solution concentration. It has been shown that measurements of C_E in a wide range of soils contaminated to various extents with Cu were a very good predictor of Cu uptake by plants.

Kinetic and thermodynamic constants

The extent of release of metal from the soil depends on the rate constant for transfer from soil to solution and the size of the labile pool of metal in the solid phase. The **distribution coefficient, K_d,** for the labile metal can be related directly to the labile soil phase pool size. By deploying DGT for different times in soils where the concentrations of metals in the pore-waters are separately measured, it is possible to provide direct estimates of K_d and the re-supply rate constant.

Summary of Project Rationale - Conventional metals concentrations in all matrices and bioavailability

Conventional metal concentrations are important to collect given the larger body of comparative data. We propose to determine metals by US EPA methods (SW-846) on Oregon soils, plants and surface and ground waters. However, the collection of biologically relevant data is also important, bioavailability, bioaccumulation and partitioning of metals under typical agronomic fertilizer applications rates and on Oregon soils needs to be a part of any risk assessment study. One excellent approach is the use of DGT where research has clearly demonstrated that insight into the supply of metals from soils can be gained by using DGT as physical surrogates for plant/organism uptake.