



STATE OF WASHINGTON

DEPARTMENT OF AGRICULTURE

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WASHINGTON STATE 2, 4-D USE SUMMARY

- 2, 4-D is a systemic herbicide that is foliar- or root-absorbed used in agriculture, in pasture and rangeland, forest management, home and garden, and to control aquatic vegetation to control a variety of broadleaf weeds.
- 2, 4-D is used mainly in post-emergence applications and is effective against many annual and perennial broadleaf weeds.
- 2, 4-D is the fourth most widely used agricultural herbicide in the United States.
- 2, 4-D may be either a Restricted Use Pesticide (RUP) or is a General Use Pesticide (GUP). See NOTE below.
- 2, 4-D may be found in amine salts and low-volatile esters.
- There are many derivatives of 2, 4-D. It is available in an amine salt and ester formulation. Amine formulations are more commonly used materials since they are relatively stable in a wide range of temperatures. Ester formulations are used in cool, rainy weather - the early spring and late fall – but are more likely to volatilize.
- 2, 4-D is best used in mixtures for broad-spectrum weed control. Formulation has no effect on long-term weed control in common use situations.
- The diethylamine salt is classified toxicity class III – slightly toxic but is considered toxicity class I – highly toxic by eye exposure. 2, 4-D is a chlorinated phenoxy compound.
- Products containing the diethylamine salt bear the signal word, “Danger/Poison” because 2,4-D has produced serious eye and skin irritation among agricultural workers.
- Some formulations of 2,4-D are highly toxic to fish while others are less so. For example, the LC50 ranges between 1.0 and 100 mg/L in cutthroat trout, depending on the formulation used.

Current Washington State Use Practices

CROP	WASS ¹ 2002 EST. ACRES	EST. % ACRES TREATED	EST. LBS. A.I./ACRE	# OF APPS	EST. ACRES TREATED	EST. LBS. A.I. APPLIED
Apple ^{2,3}	164,000	20	0.70	1.5	32,800	34,400
Aquatic weed control	See narrative.					
Asparagus	17,000	10	0.70	1.0	1,700	1,200
Barley	350,000	15	0.40	1.0	52,500	21,000
Blueberry	2,000	< 20	1.43	1.0	400	570
Cherry ³	25,000	10	0.60	1.5	2,500	2,250
Christmas tree	23,000	15	0.35	1.0	3,450	1,200
Conservation Reserve Program	Unknown					
Corn, grain & silage	130,000	15	0.75	1.0	19,500	14,625
Corn, sweet	97,900	3	0.50	1.0	2,950	1,470
Cottonwood (hybrid poplar for pulp)	40,000	10	0.50	1.0	4,000	2,000
Cranberry	1,600	Minimal usage. See narrative.				
Grape	49,800	Minimal usage. See narrative.				
Forest	22,000,000	See narrative.				
Landscape	Unknown					
Oat	35,000	20	0.50	1.0	7,000	3,500
Peach & nectarine	4,200	8	1.00	1.0	336	336
Peas, dry & wrinkled seed	See narrative.					
Pear ³	24,800	15	0.80	1.5	3,750	4,500
Rights-of-Way	Unknown					
Strawberry	1,800					
Turf (golf course)	Use not statistically relevant. See narrative.					
Turf (sod)	2,500	80	0.75	2.0	2,000	3,000
Wheat	2,490,000	40	.50	1.0	996,000	498,000

¹ Washington Agricultural Statistics Service

² Commodities noted in **BLUE** have not had peer review input.

MAJOR USES (listed alphabetically):

The major use listing supplies the most commonly used formulations of the active ingredient. No discrimination or endorsement is intended.

The pesticide labels take precedence over any information contained herein. It is the responsibility of the user to comply with the label directions provided.

The following pesticide use summary reflects the general pesticide practices for the listed commodities. The use information is not intended to reflect the pesticide application practices of any individual.

NOTE: Phenoxy hormone-type herbicides are Restricted Use Pesticides (RUP) in some areas of Washington state. Refer to the following chapters of the Washington Administration Code:

[Chapter 16-228-1231 WAC](#)

[Chapter 16-230-610 WAC](#)

[Chapter 16-230-615 WAC](#)

(All high volatile ester and dust formulations of phenoxy-hormone type herbicides are prohibited in Washington state. See [Chapter 16-228-1250 WAC](#) and [Chapter 16-228-600 WAC](#).)

When specific formulations are recommended, the following use summary will specify the formulation and use rate, if available. If the recommendation does not specify formulation, the summary will refer to the chemical as “2, 4-D” and no application rates will be provided since rate is specific to formulation.

AQUATIC WEED CONTROL:

- 2, 4-D is used to control nuisance plants and algae under a NPDES Permit issued by the Washington State Department of Ecology.
- The Nuisance Plant and Algae Control General NPDES Permit issued coverage throughout the 2003 application season to lake groups and homeowners wishing to control algae and/or native nuisance weeds in lakes and ponds.
- The lakes covered under this general permit in 2003 were all located in Ecology’s Southwest and Northwest regions.
- When applying for coverage, the applicator is required to estimate the amount of product to be used and the total area to be treated. The totals reported for 2, 4-D are:
 - 2, 4-D BEE – 1,500 gallons
 - 2, 4-D amine – 129.25 pounds
- Government agencies, lake groups, homeowners and marinas use 2, 4-D to treat lakes, rivers, and estuarine environments for noxious, nonnative plant species under a Noxious Weed NPDES Permit.
- The treated areas are located throughout the state and coverage is issued by the Washington State Department of Agriculture in partnership with the Department of Ecology.
- The total of 2, 4-D used is as follows:
 - 2, 4-D – 646.739 gallons
 - 2, 4-D – 12,870 pounds

ASPARAGUS:

- In 2002, Washington state growers harvested 17,000 acres of asparagus. The lead producing counties are: Franklin (7,000 acres), Yakima (5,400 acres), Walla Walla (1,300 acres), Grant (1,200 acres) and Benton (1,300 acres).
- Asparagus a perennial crop with harvest beginning in April and lasting 60 – 80 days. After harvest, the stems are allowed to develop into the fern stage. It is at this stage that most insect and disease problems occur.

- Approximately 30 percent of Washington's asparagus crop is sold in the fresh market. While the remainder has been produced for the processing market, the only asparagus processing plant in Washington state recently announced its closure.
- 2, 4-D amine is used to control weeds in established asparagus plantings. Post-harvest treatment for control of Canadian thistle and bindweed is recommended.
 - 2, 4-D amine (Formula 40, AgriSolutions 2, 4-D, Amine-4 or Savage) may be applied at a rate of 1.4 – 1.9 pounds active ingredient per acre to growing weeds.
 - 2, 4-D amine is applied using a ground sprayer with drop nozzles.
 - Treatments may be repeated. Applications should be at least 6 weeks apart but no more than twice per year.

BARLEY:

- Washington state had 350,000 acres in barley production in 2002. Barley production, as a cash grain, is concentrated in eastern Washington in Adams, Garfield, Lincoln, Spokane, and Whitman counties.
- Over 95 percent of the barley grown in Washington is spring barley, which is planted in early spring (generally April) and harvested in late July or August of the same year. Washington's winter barley is seeded in September or October and harvested in late July or August of the following year. Less than 5 percent is irrigated.
- End use for Washington barley is primarily feed (beef and dairy cattle, swine and poultry production) at 92 percent and malting (food, beer, beverages) at 8 percent.
 - 2, 4-D may be applied at a rate of 0.25 – 0.75 pounds active ingredient per acre for control annual broadleaf weeds.
 - Applications typically occur in the spring when barley is fully tillered but before barley joints.
 - Curtail (2, 4-D amine plus clopyralid) may also be used for annual broadleaf weed and Canadian thistle control.
 - Curtail applications occur in the spring at a rate of 0.095 – 0.126 pounds active ingredient clopyralid plus 0.5 – 0.67 pounds active ingredient 2, 4-D amine (2 – 2.66 pints Curtail) per acre.

BLUEBERRY:

- Blueberries are grown in western Washington state, primarily in Skagit (550 acres), Whatcom (720 acres), Lewis (190 acres), Clark (140 acres) and Thurston (120 acres) counties.
- 2, 4-D has a small but very important use in blueberries.
 - 2, 4-D (Saber – Washington Special Local Need # WA01-0009) may be ground applied at a rate of 1.43 pounds active ingredient in 50 gallons of water per acre as a spray directed to the weed or grass strip between rows.
 - A spring and fall treatment may be made if broadleaf weeds need control.

CHRISTMAS TREE:

- Washington State has approximately 23,000 acres of farmed Christmas trees and 29,000 acres of Christmas trees in natural stands. Nearly all Christmas trees are produced in

western Washington (Kitsap, Lewis, Mason and Thurston counties). Over 90 percent of the trees produced are Douglas, Nobel or Grand fir.

- 2, 4-D may be applied to control weeds in established tree plantings.
 - 2, 4-D ester (LV6 - several) is applied at a rate of 0.34 pounds active ingredient per acre.
 - 2, 4-D ester may be applied as an over-the-top broadcast application using a low rate or as a direct spot spray.
 - Applications should occur to actively growing weeds before bud break in the spring, typically starting in March, or after bud set if the temperatures remain cool.

CONSERVATION RESERVE PROGRAM (CRP):

- By law, certain weeds that may grow on ground in CRP must be controlled. The weeds are county-specific and vary based on locality.
 - 2, 4-D amine plus dicamba (Banvel or Clarity) may be applied at a rate of 0.25 – 1.0 pounds active ingredient 2, 4-D amine plus 0.12 – 2.0 pounds active ingredient dicamba.
 - Applications should occur in the fall or spring on grasses that are more than 1 year old.
 - Application rate should be adjusted to no more than 0.5 pounds active ingredient 2, 4-D amine plus 0.25 pounds active ingredient dicamba if treatment occurs in the establishment year.
 - Crossbow 2, 4-D ester + triclopyr) may also be used at a rate of 1 – 2 quarts product per acre to control annual broadleaf weeds or seedling perennial weeds. Increase rate to up to 1.5 gallons Crossbow for established perennial weeds.

CORN, GRAIN & SILAGE:

- In 2002, 130,000 acres of field corn were planted. Of that acreage, 70,000 acres were harvested for grain and 60,000 acres were cut for silage. Most corn is grown in the following eastern Washington counties: Franklin (11,700 acres), Grant (30,000 acres) and Yakima (25,000 acres).
- Western Washington counties produce 34,000 acres of corn with the following acres cut for silage: Whatcom (16,000 acres), Skagit (7,200 acres) and Snohomish (5,500 acres).
- 2, 4-D may be applied post-emergence to control broadleaf weeds.
 - Applications should be made with a drop nozzle at a rate of 0.5 – 1.2 pounds active ingredient per acre when corn is actively growing.
 - In western Washington, several common annual broadleaf weeds are resistance to 2, 4-D.
- Curtail (2, 4-D plus clopyralid) may be used to control broadleaf weed and suppress Canadian thistle.
 - Applications should occur when corn is less than 8 inches tall (June) as a directed spray using drop nozzles.
 - May not be used on sweet corn.

CORN, SWEET:

- In 2002, Washington state harvested 97,900 acres of sweet corn were harvested (2,600 acres for the fresh market and 95,300 picked for processing). Grant (33,000 acres), Benton (15,000 acres) and Franklin (18,000 acres) counties are Washington state's leading producers of sweet corn for processing.
- While many counties decreased sweet corn acreage in 2002, Yakima County increased sweet corn production 3-fold, going from 2,700 acres in production to 8,900 acres.
- 2, 4-D amine may be applied post-emergence to control broadleaf weeds.
 - Applications should be made at a rate of 0.5 – 0.75 pounds active ingredient per acre
 - Corn should be tall enough to use a drop nozzle.
 - In western Washington, several common annual broadleaf weeds are resistance to 2, 4-D.

COTTONWOOD (HYBRID POPLAR GROWN FOR PULP):

- There are approximately 40,000 acres of cottonwoods planted for pulp production. The acreage is located throughout Washington State. There are 9,800 acres of hybrid poplars grown in Walla Walla County.
- The goal of weed control in hybrid poplars during the first three years of growth is to keep the height of the competing vegetation less than 6 to 8 inches by flail mowing and, if necessary, herbicides. Nearly all growers keep competitive weeds in control through mowing.
- 2, 4-D amine may be used to control emerged broadleaf weeds in cottonwood stands.
 - On both new & established plantings, 2, 4-D amine (Washington Special Local Needs #WA 98-0013) may be applied at a rate of 0.24 – 1.43 pounds active ingredient per acre.
 - Applications may occur before or after planting new stands.
 - Repeat treatment may be required for less susceptible weeds.
 - Glyphosate may be tank-mixed in a pre-plant application to broaden weed control.

CRANBERRY:

- The primary location for cranberry production in Washington State is Grays Harbor County. The county hosts 80 growers on 900 acres in Grayland and 100 acres in North Beach near Ocean Shores. Pacific County has 600 acres near Long Beach in cranberry production. Whatcom County has 100 acres of cranberries near Lynden. All cranberry acreage is contracted with Ocean Spray Cranberries Inc., a growers' cooperative.
- Most of the Grayland acres are grown for fresh market and dry harvested with a picker. The cranberries in Pacific County (Long Beach) are produced for juice and wet harvested by flooding.
- 2, 4-D amine (Weedar 64) may be applied as a spot, wick application for broadleaf weeds.
 - 2, 4-D amine is not used often.

- Weedar 64 is applied in a 20 – 33 percent solution and applied only to weeds extending above the cranberry canopy.
- It is typically applied mid-summer (July – August) in a tank mix with glyphosate (RoundUp).
- No applications occur after the end of August.

GRAPE:

- The primary grape producing counties in Washington state are: Benton (15,929 acres), Yakima (15,529 acres), Grant (3,132 acres), Franklin (2,813 acres) and Klickitat (419 acres) counties.
- Grapes are produced for wine, fresh market, or juice. Irrigation varies with the type of grape produced. For example, rill irrigation is used primarily on Concord grapes produced for juice. ConCORDS require heavy watering. Drip or sprinkler irrigation is used for wine grapes for more refined control.
- Approximately one-third to one-half of grape acreage is treated with pre-emergent weed control during the dormant-delayed dormant growth period (October – April).
- The most widely used residual herbicides (in order of acres treated) would be oryzalin (Surflan), oxyfluorfen (Goal), simazine (Princep) and norflurazon (Solicam). Growers avoid using simazine, norflurazon and dichlobenil (Casoron) on light soils due to the potential for vine injury.
- 2,4-D amine has minimal usage due to grape injury. It may be used, however, to control weeds in established plantings.
 - Application should occur when weeds are vigorously growing
 - Applicators should use a directed-shielded boom with low-pressure flooding nozzles to reduce drift and injury.

FOREST:

- Weed and brush control in commercial forests to provide larger, higher quality forests and reduce the time needed to bring the crop to maturity.
- 2, 4-D and triclopyr are relatively non-injurious to Douglas fir seedlings during the dormant season but will injure noble fir and ponderosa pine.
- The forest industry uses 2, 4-D ester to control herbaceous and woody vegetation.
 - Broadcast application
 - 2, 4-D ester (LV6 - several) is applied from March-May. Triclopyr BEE (Garlon 4) is also used but applied from October – March. Ten to thirty percent of broadcast applications in forestry may require the use of these chemicals.
 - Typically, 2, 4-D ester is used in combination with a soil residual herbicide.
 - The rate of application is 2.5 – 5.0 percent herbicide in solution (1 – 2 quarts per acre) applied using backpack sprayers or helicopter spray systems.
 - This is generally a one-time treatment in a vegetation management rotation.

- Refer to Chapter 222-38 WAC for specific Washington state requirements regarding the handling, storage and application of forest chemicals. These rules include application buffers and are intended to implement best management practices designed to eliminate the direct entry of pesticides to water.

LANDSCAPE:

- Commercial landscape use 2, 4-D to control certain broadleaf weeds in lawns.
- 2, 4-D amine (0.5 - 1.0 pound active ingredient is typically used in combination with dicamba (0.25 - 0.5 pounds active ingredient) in a tank-mix – 100 gallons of tank-mix will cover 3 acres.
- Applications occur 2 times per year – once in the spring after the rains and once in the fall before the rains begin.
- Amine formulations are typically used near ornamentals because ester formulations have drift and volatility problems.

OAT:

- In Washington state, oats are produced primarily as a cover crop, for stand establishment in alfalfa, for hay, and for export to Japan.
- Washington state had 35,000 acres in oat production in 2002 with 10,000 acres harvested for grain. Oat is grown in many Washington counties, but concentrated production is located in Klickitat County (eastern Washington).
- 2, 4-D may be used to control annual broadleaf weeds in oats.
 - 2, 4-D is applied at a rate of 0.25 – 0.5 pounds active ingredient per acre.
 - Applications should occur after plants are fully tillered but before boot.
 - Note: Not all 2, 4-D is registered for this use.

ORCHARD CROP:

- In 2002, Washington State had over 220,000 acres in fruit production:
 - ✓ apples – 164,000 acres
 - ✓ apricots – 1,300 acres
 - ✓ cherries – 25,000 acres
 - ✓ peaches & nectarines – 4,200 acres
 - ✓ pears – 24,800 acres
 - ✓ prunes & plums – 1,000 acres
- The Yakima Valley in eastern Washington is the most productive fruit growing area in the state, producing nearly 1.5 million tons of fruit. The Yakima Valley out-produces the next most productive area, Wenatchee (with production of 1.0 million tons), by half. However, Wenatchee does produce over 3 times more pears than what is grown in the Yakima Valley.
- 2, 4-D amine (Weedar 64) is used for control of most annual and perennial broadleaf weeds in orchard crops.
 - 2, 4-D amine is applied directly to weeds while avoiding contact with foliage, limbs, and trunk.

- 2, 4-D amine may be used at any time except bloom. It is typically applied during the dormant/delayed dormant growth stage (April 1 –15) of bud development.
- 2, 4-D amine should be applied when weeds are small and growing actively.
- The tree roots can absorb 2,4-D and cause serious injury to the tree.
- Specific crop use information for 2, 4-D amine is as follows:
 - Apple: approximately 20 percent of apple crop is treated 1.5 times with 2, 4-D at a rate of 0.70 pounds active ingredient per acre
 - Cherry: approximately 10 percent of apple crop is treated 1.5 times with 2, 4-D at a rate of 0.60 pounds active ingredient per acre
 - Peach & nectarine: approximately 8 percent of apple crop is treated 1 time with 2, 4-D at a rate of 1.0 pounds active ingredient per acre
 - Pear: approximately 15 percent of apple crop is treated 1.5 times with 2, 4-D at a rate of 0.80 pounds active ingredient per acre
- 2, 4-D ester plus triclopyr (Crossbow – Washington Special Local Needs #01-0038) may be used to control unwanted trees in orchards that are abandoned or no longer managed for production. This treatment removes host trees that may be a source of codling moth or other insect infestation.
 - Crossbow is mixed as a 4 percent mixture with dormant oil or diesel oil (4 gallons of Crossbow per 100 gallons of spray).
 - Applied as a basal application, cut stump treatment or by hack-and-squirt method.
 - Treatment is most effective when applications occur in winter to early spring.

PEA, DRY & WRINKLED SEED:

- In 2002, Washington state had over 70,000 acres in dry pea production. Whitman County has the largest amount of acres in dry peas followed by Spokane County.
- Over 97 percent of the dry peas produced in the United States are within a 90-mile radius of Pullman, Washington (the “Palouse” region of Washington state). Counties include not only Whitman and Spokane but also Garfield and Asotin.
- Irrigated dry pea acreage is found in the Columbia Basin counties of Grant, Adams, Benton, and Franklin. Irrigated acreage is in rotation with potato and the acreage is small in comparison to that of the Palouse counties.
- Dry peas are planted in mid-April and harvested in mid-July. The peas dry on the plant in the field and are harvest mechanically.
- 2, 4-D is typically applied post-harvest to control Canadian thistle.
 - Formulation is based on timing and temperature. Amine is most frequently used due to warmer weather. However, use and formulation is a varied as the customer base.

- See particular label for rate.

RIGHTS-OF-WAY (FORESTRY):

- The forest industry uses 2, 4-D to control encroaching vegetation on forest roads.
 - The majority (90 plus percent) of any roadside spray project is treated with 2, 4-D ester (LV6 - several).
 - Depending on the vegetation species, ten to thirty percent of the project may be treated with 2, 4-D tank-mixed with triclopyr BEE. Glyphosate (Accord Concentrate) may also be used in combination with 2, 4-D and triclopyr BEE.
 - Typically, the rate is 2.5 – 5.0 percent herbicide in solution. Rate is dependant on the intensity of the target vegetation.
 - Applications occur from the later part of May through the first part of August using an injection system that controls the herbicides/rates being sprayed by computer-calibrated "push-button" system.
 - Forest roads need to be re-treated every 2 – 5 years.
 - Refer to Chapter 222-38 WAC for specific Washington state requirements regarding the handing, storage and application of forest chemicals. These rules include application buffers and are intended to implement best management practices designed to eliminate the direct entry of pesticides to water.

RIGHTS-OF-WAY (WASHINGTON ROADS)

- The Washington State Department of Transportation no longer uses either 2, 4-D or triclopyr BEE as part of its highway and roads IPM Program.

STRAWBERRY:

- Strawberries are grown in western Washington: Whatcom (380 acres), Skagit (550 acres), Clark (320 acres), Pierce (100 acres) and other counties.
- 2, 4-D may be applied to control existing broadleaf weeds.
 - Applications must occur when the weeds are actively growing but the strawberry plants must be in completely inactive in “summer” or “winter” dormancy to reduce chance crop injury from the herbicide.
 - See specific label for rate.

TURF (GOLF COURSE):

- 2, 4-D has little use on golf courses in Washington state.
- A typical golf course is approximately 150 acres - of that 110 acres is turf. The following turf area averages may require weed control: 2.7 acres greens, 2.5 acres tees, and 27 acres fairways.
- However, 2, 4-D may not be used on bent grasses (greens) and weed control is achieved on the tees and fairways by keeping the grass mowed short.
- If control of English daisy, dandelion and veronica is required, 2, 4-D may be spot-sprayed. Area that may require treatment is estimated at no more more than 10,000 square feet.

TURF (SOD):

- 2, 4-D is typically used in a tank-mix to control a broad range of weeds.
- 2, 4-D is used in both amine and ester formulations. The chemical may be applied alone, as part of a tank-mix, and/or as a component of an herbicide product.
- Application rates are specific to the product used and generally have low component rates.
- Applications are typically made using ground equipment in the spring after the rains and again in the fall before the rains start.

WHEAT:

- Washington state produced 2.42 million acres of wheat (spring & winter) in 2002. Spring wheat acreage was 620,000 acres and winter wheat acreage was 1.8 million acres. Common white winter wheat makes up 61 percent of all wheat grown in Washington state.
- Whitman County is the largest wheat producer in Washington state with 493,500 acres planted in 2002.
- The southeast area of Washington state (Asotin, Columbia, Garfield, Walla Walla and Whitman counties) produces the majority of wheat with 919,600 acres planted in 2002.
- The east central area of Washington state (Adams, Douglas, Franklin and Grant counties) has dropped to second in wheat production with 744,900 acres planted in 2002.

- Generally one application of a given pesticide is made per year. Planting dates vary throughout the year, depending on the environmental influence and geographic location of the field. This creates a wide fluctuation in timing of pesticide applications. The timing provided in this summary represents the time of year when these pesticides may be applied. Herbicides are always used in a wheat cropping system.

NOTE: The crop table on page 1 lists acreage for both winter and spring wheat produced in Washington state.

- 2, 4-D may be applied post-emergent to control broadleaf weeds.
- 2, 4-D is used in both amine and ester formulations. The chemical may be applied alone, as part of a tank-mix, and/or as a component of an herbicide product.
- Application rates are specific to the product used.
- Applications may be made by ground (boom or spot treatment) or by air.
- Few, if any, applications are made in November, December or January.

References:

2003 Farm Chemicals Handbook, Meister Pro Information Resources

2003 Pacific Northwest Weed Management Handbook, Extension Services of OSU, WSU, and UI

2004 Washington State registered pesticide labels

Aquatic Pesticide Use During the 2003 Application Season as reported to the Washington State Department of Ecology.
Washington State Department of Ecology Water Quality Program. September 30, 2004

CDMS Label Database: <http://www.cdms.net/manuf/manuf.aspwebsite>

ExToxNet Pesticide Information Profiles: <http://ace.orst.edu/info/extoxnet/pips/pips.html>

Greenbook, Chemical & Pharmaceutical Press Inc.: <http://www.greenbook.net/>

National Agricultural Statistics Service – Agricultural Chemical Use Database: <http://www.pestmanagement.info/nass/>

National Pesticide Use Database: <http://www.ncfap.org/database/default.php>

Pesticide Action Network Pesticide Database: <http://www.pesticideinfo.org/index.html>

U.S. Department of Agriculture National Agricultural Statistics Service: <http://www.usda.gov/nass/>

U.S. Department of Agriculture Pest Management Centers Crop Profiles: <http://www.pmcenters.org/cropprofiles/>

U.S. Department of Agriculture Crop Profiles: <http://pestdata.ncsu.edu/cropprofiles/>

Washington 2003 Annual Bulletin, Washington Agricultural Statistics Service ,
<http://www.nass.usda.gov/wa/annual03/content3.htm>

Washington State Pesticide Management Practices: <http://www.tricity.wsu.edu/~cdaniels/wapiap.html>

WSU PICOL Label/Crop Profile Database: <http://picol.cahe.wsu.edu/LabelTolerance.html>

WSU Pesticide Notification Network, <http://ext.wsu.edu/pnn/user/blank.php>

E-mail correspondence – Mark Sheldahl, October 7, 2004, Weyerhaeuser Inc. (forestry)

Personal communication – Bret Beardslee, November 2, 2004, Spring Green Lawn & Tree Care, Lacey (landscape)

Personal communication – Brain Cieslar, Fieldman, November 2, 2004, Whatcom Farmers Coop, Lynden (berries)

Personal communication – Steve Kealy, November 2, 2004, Western Washington Golf Course Superintendents Assn. (turf grass)

Personal communication – Alan Kottwitz, November 2, 2004, Crop Production Supervisor, Boise Fiber Farm, Wallula
(cottonwood)

Personal communication – Pat McGreevey, Fieldman, October 14, 2004, The McGregor Company, Dayton (pea, dry)

Personal communication – Dr. Kim Patten, April 10 & 12, 2002, June 16, 2003, WSU Research Station, Long Beach
(cranberries)

Personal communication – Gwen Stahnke, October 14, 2004, Department of Crop & Soil Science, Washington State University,
Puyallup (turf, golf course turf)

Personnel communication – Joe Yenish, Assistant Scientist/Extension Specialist, November 2, 2004, Washington State
University, Pullman (small grains)