Onions

Dry bulb and green onions, leeks, shallots, and spring onions

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Revised November 24, 2009

ONIONS—Site Preparation, Stale Seedbeds, and Selective Postemergence Applications

See "Site Preparation," "Registered Uses for Glyphosate," and "Registered Uses of Aim Herbicide in Food Crops" at the beginning of the Vegetables section of this handbook.

ONIONS—Preplant

bensulide (Prefar 4-E)

Not for use in Willamette Valley of Oregon; dry bulb onions and shallots only

Rate 5 to 6 lb ai/A (5 to 6 quarts/A)

Time Fall application, during bed construction: apply after markout when soil temperature is below 60°F. Spray over beds and incorporate with water or mechanically. Spring application: apply preplant incorporated or preemergence in band or broadcast and incorporate with rain or irrigation. Apply enough overhead irrigation to wet 2 to 4 inches of soil or enough furrow irrigation to wet across seed beds.

Remarks Special local needs label available (WA-940010). Shallow mechanical incorporation can be substituted to maintain the herbicide above the onion seed. If mechanically incorporated, use spike-tooth harrow, smizer roller, or similar equipment to maintain shallow and uniform layer of herbicide within the upper 1 inch of soil for sandy soils or the upper 0.5 inch for loam soils. Use low rates on sandy soils. Will not control germinated weed seedlings. Inhibits roots of seedlings.

Site of action Group 8: lipid synthesis inhibitor but not an ACCase inhibitor

Chemical family Organophosphorus

S-metolachlor (Dual Magnum)

Fall preplant for yellow nutsedge control in dry bulb onions; Oregon and Idaho only

Rate and Time East of Cascades: apply 1.27 lb ai/A (1.33 pints/A) in fall after crop harvest but before freeze-up. Fall applications of Dual Magnum can be surface-applied. However, recent experience at the OSU Malheur Experiment Station indicates onions may be injured if Dual Magnum is not sufficiently incorporated in fall and if weather remains cold and wet after onions are planted in spring. To reduce risk of crop injury, apply at least 100 days before planting onion seed, sets, or transplants. West of Cascades: apply 1.27 lb ai/A (1.33 pints/A) of Dual Magnum in fall. Use low rate on mineral soils and high rate on muck soils. Apply before fall rains begin or after the first light rain. Do not incorporate Dual Magnum with tillage, as this will reduce yellow nutsedge control. To reduce risk of crop injury, apply at least 130 days before planting onion seed, sets, or transplants.

Remarks Indemnified special local needs labels OR-040009 and ID-9900016 available at http://www.farmassist.com Dual Magnum inhibits roots and shoots formation.

Caution Risk of crop injury is greater on light-texture soils and at higher application rates. Tank-mixes with other pesticides may increase potential of crop injury. Only one application in fall is recommended. No more than 1.33 pint/A in a single fall preplant application. Avoid areas with shallow groundwater and directly applying to water.

Site of action Group 15: inhibits very long chain fatty acid synthesis

Chemical family Chloroacetamide

ONIONS—Preemergence, Delayed Preemergence, Early Postemergence

DCPA (Dacthal Flowable)

Rate 4.5 to 10.5 lb ai/A (6 to 14 pints/A)

Time Apply after planting to soil surface before weeds germinate and onions emerge.

Remarks Performs erratically west of the Cascades. In eastern Oregon and Washington, if overhead irrigation is not available, apply and shallowly incorporate herbicide with a nailboard. Rain after incorporation improves weed control. Results improve with overhead irrigation immediately after application. Consult label for planting sensitive crops within 8 mo. Inhibits mitosis.

Site of action Group 3: microtubule assembly inhibitor

Chemical family Phthalic acid

dimethenamid-P (Outlook)

Dry bulb onions, garlic, and dry bulb shallots

Rate 0.56 to 0.84 lb ai/A (12 to 18 fl oz/A) on coarse soils and 0.84 to 0.98 lb ai/A (18 to 21 fl oz/A) in medium-texture or fine soils. May be applied in a single application. Do not exceed 21 fl oz/A per season.

Time Apply postemergence from the two-true leaf stage until at least 30 days before harvest.

Remarks Split applications of 10 to 14 oz/A followed by 7 to 14 oz/A are permitted but cannot exceed a total of 21 oz/A. Refer to the EPA-approved labels for specific application methods and requirements.

Caution Applications before the two-true-leaf stage may significantly injure the crop. Aerial applications must leave a 150-ft untreated buffer between treatment area and endangered plant populations. Ground applications must use low-pressure nozzles that produce only medium to coarse or very coarse droplets and leave a 35-ft untreated buffer between treatment area and endangered plant populations.

Site of action Group 15: inhibits very long chain fatty acid synthesis

Chemical family Chloroacetamide

ethofumesate (Nortron SC)

Dry bulb onions and shallots only

Rate Preemergence: 0.5 to 1 lb ai/A (16 to 32 fl oz/A) depending on soil texture. Weed control diminishes in soils with fine texture or high organic matter. Postemergence: 0.5 lb ai/A (16 fl oz/A) with up to four evenly spaced sequential applications.

Time Apply after planting and activate with at least 0.5 inch of water, or apply after crop emerges.

Remarks Do not use smaller than 50 mesh screen and avoid overlaps, which may increase risk of crop injury. For postemergent applications, rain or irrigation within 6 hr after application may reduce weed control.

Caution May cause temporary leaf fusion, distortion, and stunting when used as label directs and under normal growing conditions. If crop is lost due to unfavorable growth conditions after application, do not plant anything except sugar beets, table beets, onions, garlic, shallots, or ryegrass.

Site of action Group 16: unknown

Chemical family Benzofuran

oxyfluorfen (GoalTender, Goal 2XL, or Galigan 2E)

Dry bulb onion, green onions (via sprinkler application)

Rate 0.12 to 0.25 lb ai/A (0.25 to 0.5 pint/A GoalTender) in direct-seeded and transplanted onions.

Time Apply postemergence to onions with two fully developed true leaves while broadleaf weeds have fewer than four true leaves. Goal applications are allowed on green onions through sprinkler irrigation systems (Special local needs label OR020027). Read and follow label instructions precisely regarding irrigation interval and all chemigation specifications to minimize environmental hazards.

Remarks Multiple treatments may be required as new weeds emerge, but do not exceed 0.5 lb ai/A (maximum of 2.5 pints/A per use season). Use a clean sprayer and do not mix with oils, surfactants, or other agricultural chemicals. Apply when susceptible weeds are in the two- to four- leaf stage and actively growing. Acts as a selective contact herbicide that disrupts cell membranes.

Caution Do not apply to onions under any stress. Leaves may curl slightly, and young plants sometimes become prostrate on the soil surface for 1 to 2 days, but yields have not been reduced. Preharvest interval is 45 days. Goal damages some onion varieties more easily than others; "Walla Walla" sweet onions are very sensitive. Check with your seed supplier for information regarding the variety you wish to plant.

Site of action Group 14: protoporphyrinogen oxidase inhibitor

Chemical family Diphenylether

pendimethalin (Prowl 3.3EC or Prowl H2O)

Dry bulb onions and shallots only, direct-seeded or transplanted

Rate 0.5 to 1.48 lb ai/A (1.2 to 3.6 pints/A Prowl 3.3)

Time Delayed preemergence for dry bulb onion only (after onion seed germinates but before it emerges); and after onions emerge (two- to nine-true-leaf stage). Delayed preemergence: apply Prowl H2O when 75% of dry bulb onion seed radicals have emerged. Determine radical status by digging onion seedlings at random locations in a field and noting radical length. Plant onions at least 1 inch deep to mitigate risk of injuring them.

Remarks Special local needs labels are available for delayed preemergence for Prowl H2O (OR060008, WA070004, and ID060009) from several grower associations in western and eastern Oregon, Washington and Idaho. Adjust rates according to soil texture. Rain or overhead irrigation is needed within 10 days for activation. Inhibits mitosis, both in shoots and roots.

Caution Be aware of crop-rotation restrictions, including for sugar beets, winter wheat, and winter barley.

Site of action Group 3: microtubule assembly inhibitor

Chemical family Dinitroaniline

S-metolachlor (Dual Magnum)

Early postemergence for yellow nutsedge control in dry bulb onion; Oregon, Idaho, and Washington

Rate and Time Apply at two-true-leaf stage of onions at 0.67 to 1.33 pints/A (0.64 to 1.27 lb ai/A). Another application of 0.67 to 1.33 pints/A may be made 21 or more days after the first, if needed, provided Dual Magnum was not applied preplant in fall.

Remarks Indemnified special local need labels OR-040009 and ID-9900016 are available at http://www.farmassist.com. The Washington special local need label (WA-990023) is distributed only by the Walla Walla Sweet Onion Growers Association. Excessive rain or cold, wet conditions after application may reduce plant stand and cause stunting and yield loss. Onion tolerance to Dual Magnum increases with increasing onion size.

Caution **Restricted use in Washington.** (1) Do not apply within 60 days of harvest. (2) Do not harvest green onions. (3) Do not apply this product through any type of irrigation system. (4) Do not graze animals on green forage or stubble. If a fall preplant application of Dual Magnum was used for nutsedge, only one postemergence application at a maximum rate of 1.33 pints/A is allowed. Do not apply more than 2.68 pints/A to dry bulb onions as a combined total across all application timings and use patterns to produce that crop.

Site of action Group 15: inhibits very long chain fatty acid synthesis

Chemical family Chloroacetamide

ONIONS—Postemergence

bromoxynil (Buctril or Broclean)

Idaho and east of Cascades, dry bulb and green onions only

Rate 0.25 to 0.38 lb ai/A (1 to 1.5 pints/A)

Time Apply in 50 to 70 gal water for thorough coverage when onions have two to five true leaves. Apply on sunny days when plants are dry and humidity is low.

Caution Do not ingest or inhale spray mist, and prevent contact with skin. Wear protective face shields, respirators, and clothing. Do not apply west of Cascades or when protective waxy cuticle on onion leaves may be thin or damaged. Do not add adjuvants. Injury can sometimes occur, even under ideal conditions.

Site of action Group 6: photosystem II inhibitor

Chemical family Nitrile

carfentrazone (Aim)

Rate up to 0.031 lb ai/A (0.5 to 2 fl oz/A Aim EC) per application in at least 10 gal/A of finished spray

Time Apply (post-emergence only) with hooded sprayer between rows of emerged crop.

Remarks See the table of approved uses on vegetable crops under "Selective Postemergence Applications" at the beginning of the Vegetables section of this handbook. Hooded sprayers must prevent spray from reaching green stem tissue, foliage, blooms or fruit of the crop. Do not use for pre-plant burndown on fields intended for bulb vegetables.

Site of action Group 14: protoporphyrinogen oxidase inhibitor

Chemical family Triazinone

clethodim (Select 2EC for dry onions only or Select Max for dry and green onions; supplemental label)

Rate Consult labels for information on dry and green onion.

Time Apply to actively growing grass weeds, including annual bluegrass, at growth stage on label.

Remarks Read label carefully for adjuvant instructions and about effects of rain within 1 hr, applying other pesticides, or cultivation. May be applied to onions and garlic by sprinkler irrigation systems.

Caution Consult labels for maximum rates per application and season. Preharvest interval is 45 days for dry bulb onions, 14 days for green onions.

Site of action Group 1: acetyl CoA carboxylase (ACCase) inhibitor

Chemical family Cyclohexanedione

fluazifop (Fusilade DX)

Dry bulb onions only

Rate 0.125 to 0.188 lb ai/A (8 to 12 oz/A) depending on target weed species and growth stage.

Time Apply to actively growing grasses with 1% crop oil or 0.25% nonionic surfactant. Results often are erratic on grasses stressed from lack of vigor, drought, high temperature, or low fertility.

Remarks Identify grasses; adjust rates depending on susceptibility and stage of weed growth as label instructs. More mature grasses and quackgrass can be controlled but may require two applications. Annual bluegrass and all fine fescues resist treatment. Inhibits fatty acid production, cell membranes, and new growth.

Caution Preharvest interval is 45 days. Do not exceed 3 pints/A per year. Grazing is prohibited.

Site of action Group 1: acetyl CoA carboxylase (ACCase) inhibitor

Chemical family Aryloxyphenoxy propionate

fluroxypyr (Starane Ultra)

Dry bulb onions only

Rate 0.125 lb ae/A (0.35 pints/A product)

Time Apply broadcast postemergence from the two-true-leaf stage though the six-leaf stage. Weeds should be 4 to 8 inches tall.

Remarks Special local needs labels OR-080026, ID-080007, and WA-080008 for control of kochia, volunteer potatoes, and other susceptible broadleaf weeds. Adjuvants are not recommended. Heavy flushes of weeds can be controlled with two sequential applications at 10- to 14- day intervals. Do not exceed 0.7 pint/A or two applications per year.

Caution Crop injury may occur with some onion varieties. Applications after the six-leaf stage should be made as a directed spray with drop nozzles. Do not broadcast after the six-leaf stage. Do not apply through any type of irrigation system. Preharvest interval is 42 days.

Site of action Group 4: synthetic auxin

Chemical family Pyridine

paraquat (Gramoxone Inteon)

Rate 0.63 to 1 lb cation/A (2.5 to 4 pints/A)

Time Apply before, during, or after planting but before crop emerges to control emerged weed seedlings only.

Remarks Add a nonionic surfactant or crop oil concentrate according to label specifications, taking care to avoid anionic formulations that react in the tank to form insoluble precipitates. Acts as contact; absorbs energy from photosynthesis, forming peroxides that disrupt living cells.

Caution **A restricted-use pesticide.** Do not ingest or inhale spray mist. Wear protective face shields, respirators, and clothes. Do not exceed 4 pints/A per season. Preharvest interval is 60 days.

Site of action Group 22: photosystem 1 electron diversion

Chemical family Bipyridilium

sethoxydim (Poast)

Rate 0.19 to 0.28 lb ai/A (1 to 1.5 pints/A) depending on target grass species and growth stage

Time Apply at optimum growth stage as on label.

Remarks Identify susceptible grasses, and add 2 pints/A nonphytotoxic crop oil concentrate to improve leaf absorption. Results often are erratic if grasses are stressed from lack of vigor, drought, high temperature, or low fertility. Resistant grasses include annual bluegrass and all fine fescues, but quackgrass can be suppressed. Inhibits fatty acid production, cell membranes, and new growth.

Caution Preharvest interval is 30 days. Do not exceed 4.5 pints/A per season.

Site of action Group 1: acetyl CoA carboxylase (ACCase) inhibitor

Chemical family Cyclohexanedione

trifluralin (Treflan TR-10)

Dry bulb onions only

Rate 0.38 to 0.63 lb ai/A (3.75 to 6.26 lb/A broadcast rate)

Time Apply at layby as a directed spray to the soil between rows, and incorporate immediately with sweeps or rolling cultivators.

Remarks Use proportionately less when treating area between rows only. Inhibits mitosis in shoots and roots.

Caution Do not apply to soils with more than 3.5% organic matter, or effectiveness will be reduced. Do not apply preplant or preemergence. Preharvest interval is 60 days. Remove emerged weeds before applying. See label for planting sensitive crops within 12 mo.

Site of action Group 3: microtubule assembly inhibitor

Chemical family Dinitroaniline

ONIONS—Sprout Inhibition

maleic hydrazide (Royal MH-30)

Rate 2 lb ai/A (1.33 gal/A)

Time Apply when bulbs are fully mature, with soft necks and five to eight green leaves, or when about 50% of the tops have fallen but are still green.

Remarks Apply at temperatures below 80-85°F to avoid crystallization on leaf surfaces. Using a spray adjuvant is suggested in arid regions west of the Rocky Mountains. Avoid early sprays, before maturity, to reduce spongy onions.

Caution Do not treat seed onions.

Site of action Not well understood

Chemical family None generally accepted

Peas (Green or English)

Tim Miller

Revised December 16, 2009

PEAS (GREEN OR ENGLISH)—General Weed Management Strategy

Peas are drilled in closely spaced rows early in spring, which limits weed emergence and species diversity. Most growers apply herbicides to suppress or eliminate weed competition or potential contamination of harvested product. Subsequent crop rotations during the same season limit herbicide choices to those exhibiting brief soil residuals.

PEAS (GREEN OR ENGLISH)—Stale Seedbed Method

Refer to “Stale Seedbeds” in the Vegetables section of this handbook for information on the following options.

- carfentrazone
- flaming
- glyphosate
- paraquat
- pelargonic acid

PEAS (GREEN OR ENGLISH)—Preplant Incorporated

imazethapyr (Pursuit)

Rate Consult labels.

Time Apply only once per year. Preharvest interval is 6 days for peas. See label about planting rotation crops.

Remarks Registered only in certain eastern Oregon and Washington counties, and in Idaho.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Imidazolinone

pendimethalin (several trade names)

Rate 0.5 to 1.5 lb ai/A

Time Apply and incorporate up to 60 days before planting. Rate depends on soil texture.

Remarks Thoroughly mix previous crop residue into soil 4 to 6 inches before applying.

Caution Do not apply more than once per season. Do not apply to peas, pea forage, pea silage, pea hay, or pea straw grown for livestock feed.

Site of action Group 3: microtubule assembly inhibitor

Chemical family Dinitroaniline

triallate (Far-Go)

Rate 1.25 to 1.5 lb ai/A (2.5 to 3 pints/A)

Time Apply within 3 wk of planting. Incorporate immediately, using a disk or spike-tooth harrow.

Remarks Controls wild oat and annual ryegrass.

Site of action Group 8: lipid synthesis inhibitor but not an ACCase inhibitor

Chemical family Thiocarbamate

triallate (Far-Go) + trifluralin

Rate 1.25 lb ai/A + 0.375 lb ai/A, respectively

Time Apply within 3 wk of planting. Incorporate within 24 hr, using disk or spike-tooth harrow.

Remarks Provides better control of wild oat at a lower rate of trifluralin.

Caution Do not use foliage from treated peas for feed or forage. Peas may show leaf crinkling and delayed maturity, particularly on heavy soils.

Site of action (triallate) Group 8: lipid synthesis inhibitor but not an ACCase inhibitor; (trifluralin): Group 3: microtubule assembly inhibitor

Chemical family (triallate) thiocarbamate; (trifluralin) dinitroaniline

triallate + trifluralin (Buckle)

Rate 10 to 12 lb/A granular

Remarks Follow label directions and note comments above.

Site of action (triallate) Group 8: lipid synthesis inhibitor but not an ACCase inhibitor; (trifluralin): Group 3: microtubule assembly inhibitor

Chemical family (triallate) thiocarbamate; (trifluralin) dinitroaniline

trifluralin (several trade names)

Rate 0.5 to 0.75 lb ai/A

Time Apply preplant, and incorporate 1 to 2 inches deep within 24 hr, by cross-disking, rototilling, or cross-tilling with a field cultivator.

Remarks Spray only once per season. Avoid overlapping. Use lower rate on coarse soils. Peas have been stunted when maximum labeled rates were applied uniformly in fields with slight variations in soil type. Consult label for planting sensitive crops within 12 mo.

Site of action Group 3: microtubule assembly inhibitor

Chemical family Dinitroaniline

PEAS (GREEN OR ENGLISH)—Preemergence Soil-applied

clomazone (Command 3ME)

Rate 0.5 lb ai/A (1.3 pints/A)

Time Apply to soil before or after seeding but before crop emerges.

Remarks See label for crop rotation restrictions and application requirements to avoid crop injury or vapor drift to sensitive plants. Some temporary chlorosis of green peas may occur. Avoid overlaps while spraying.

Caution Do not mix or apply within 1,000 ft of landscapes, orchards, vegetable gardens, berry patches, or property lines to prevent chemical trespass. Evidence west of Cascades suggests that lower rates of 0.25 to 0.33 lb ai/A (11 to 14 fl oz/A) control susceptible weeds in early spring. Do not graze cover crops, or harvest food or feed within 9 mo of application. Do not allow livestock to graze on treated pea vines or vine trash.

Site of action Group 13: inhibits DOXP synthase

Chemical family Isoxazolidinone

metribuzin (several trade names)

Rate 0.25 to 0.38 lb ai/A (5.3 to 8.1 oz/A)

Time Apply once per season, soon after planting, and incorporate with irrigation or cross-harrow to ensure uniformity within top 1 to 2 inches of soil.

Remarks Adjust rates for soil texture and organic matter. Do not exceed 0.15 lb ai/A (3.2 oz/A) on wet soils.

Caution **Restricted-use herbicide in Washington.** Do not use on coarse, sandy, or shallow soils, or on soils with less than 1.5% organic matter. Crop may be injured if heavy rain follows application. Do not apply more than 0.5 inch of irrigation within 1 mo after metribuzin application, to avoid crop injury. Experience is lacking in western Oregon; try small areas before treating large acreages. Crop may be injured if plants are stressed by cold weather, poor soil fertility, and disease or insect damage. Will not control weeds resistant to triazine (atrazine) herbicides. Grazing is permitted 40 days after treatment. Certify that pea variety, location, and irrigation conditions are listed on the product label you purchase.

Site of action Group 5: photosystem II inhibitor

Chemical family Triazinone

S-metolachlor (Dual Magnum)

Rate 0.95 to 1.91 lb ai/A

Time Apply preemergence behind planter and activate with moisture.

Remarks May delay maturity and/or reduce yields if soils are cold and wet after planting.

Caution Preharvest interval is 120 days for hay.

Site of action Group 15: inhibits very long chain fatty acid synthesis

Chemical family Chloroacetamide

PEAS (GREEN OR ENGLISH)—Postemergence

bentazon (Basagran)

Rate 0.75 to 1 lb ai/A (1.5 to 2 pints/A)

Time Apply as pea tolerance increases, as waxes develop on leaf surfaces.

Remarks Crop age (three leaf pairs or four nodes), temperature, weather, and spray additives affect penetration through waxes into pea leaves. Small, newly emerged broadleaf weeds can be controlled in early spring, at cool temperatures (75°F day, 55°F night), by adding a highly refined nonphytotoxic oil concentrate (see label). Temporary leaf symptoms may occur, but peas mature normally. Avoid conditions that enhance excessive penetration into pea leaves, such as temperatures over 80°F, or application on a sunny day immediately after several cloudy days.

Caution Do not tank-mix with spray additives or pesticides except MCPA and MCPB (without crop oil). Preharvest interval is 30 days. Do not exceed 2 lb ai/A (4 pints/A) per season.

Site of action Group 6: photosystem II inhibitor

Chemical family Benzothiadiazole

clethodim (several trade names)

Rate 0.068 to 0.12 lb ai/A (9 to 16 oz/A on annual grasses; 12 to 16 oz/A on perennial grass weeds)

Time Apply to actively growing grasses at recommended weed heights.

Remarks Recommended surfactant is nonionic surfactant at 0.25%; do not add ammonium sulfate.

Caution Do not exceed 32 fl oz/A per yr. Allow at least 14 days between applications. Preharvest interval is 30 days.

Site of action Group 1: acetyl CoA carboxylase (ACCase) inhibitor

Chemical family Cyclohexanedione

MCPA (several trade names)

Rate 0.125 to 0.38 lb ae/A

Time Apply postemergence to control small broadleaf weeds or prevent flowering in larger weeds such as nightshade when peas exceed 4 to 6 inches.

Remarks Adjust rates for expected temperatures; see label.

Caution Do not apply if temperature may exceed 90°F within 24 hr. Maintain spray pressure below 40 psi to minimize drift from target field.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

MCPB (Thistrol)

Rate 0.5 to 1.5 lb ae/A (2 to 6 pints/A)

Time Apply at six- to twelve- node stage for peas, and to Canada thistle during stem elongation but before 8 inches tall. Higher rate required during cool weather.

Remarks Prevents development of Canada thistle buds and contamination of harvested product. Some evidence exists that early-morning applications are safer to crop than afternoon applications.

Caution Do not feed treated peas or vines to livestock. Do not spray when air exceeds 90°F or when peas are moisture stressed.

Site of action Group 4: synthetic auxin

Chemical family Phenoxy acetic acid

metribuzin (several trade names)

Rate 0.09 to 0.25 lb ai/A (2 to 5.3 oz/A)

Time Apply only once per season, to susceptible broadleaf weeds less than 2 inches tall or wide.

Remarks Do not apply more than 0.5 inch of irrigation within 1 mo after metribuzin application because crop may be injured. In western Oregon, try small areas before treating large ones. Warm weather or tank-mixes with bentazon have caused injury west of the Cascades. Preharvest interval is 50 days; grazing is permitted after 40 days. Ensure peas, location, or irrigation conditions are listed on product label. Special local needs label WA-040031 (only for Sencor herbicide) allows a shorter preharvest interval (40 days) in western Washington if Sencor rate is less than 0.2 lb ai/A (3.5 oz/A).

Caution **Restricted-use herbicide in Washington.** Do not apply to wet crop foliage, or to very moist soil surface. Do not apply within 3 days after cool, wet, or cloudy weather or within 24 hr of other pesticide applications (except tank-mixes specified on label) to minimize risk of crop injury. Do not use on coarse, sandy, or shallow soils or on soil with less than 1.5% organic matter.

Site of action Group 5: photosystem II inhibitor

Chemical family Triazinone

quizalofop (Assure II)

Rate 0.04 to 0.08 lb ai/A

Time Apply at optimum growth stage listed on label.

Remarks Identify susceptible grasses, and add 4 quarts crop oil concentrate or 1 quart nonionic surfactant/100 gal of spray mix. Grass control may be reduced if applied immediately before or after a broadleaf herbicide.

Caution Do not mix with, or apply with, any other pesticide except as specified on label. Do not apply to plants stressed from lack of moisture, cold, or injury from herbicides, insects, or disease. Preharvest interval is 30 days. Do not exceed 0.1 lb ai/A per season.

Site of action Group 1: acetyl CoA carboxylase (ACCase) inhibitor

Chemical family Aryloxyphenoxy propionate

sethoxydim (Poast)

Rate Consult label.

Time Apply at optimum growth stage listed on label.

Remarks Identify susceptible grasses and add 2 pints/A nonphytotoxic crop oil concentrate to improve leaf absorption. Control often is erratic on grasses stunted or stressed from drought, high temperatures, or low fertility. Tolerant grasses include annual bluegrass and all fine fescues, but quackgrass can be suppressed.

Caution Do not mix or apply with any other pesticide, additive, or fertilizer except as specified on label. Preharvest interval is 15 days. Do not exceed 0.75 lb ai/A (4 pints/A) per season.

Site of action Group 1: acetyl CoA carboxylase (ACCase) inhibitor

Chemical family Cyclohexanedione

Rhubarb

Ed Peachey

Revised December 27, 2009

clethodim (Select or Prism)

Oregon and Washington only

Rate 0.094 to 0.125 lb ai/A (6 to 8 oz/A Select)

Time Apply to actively growing grass weeds, including annual bluegrass, at growth stages on label.

Remarks Read label carefully for adjuvant instructions; note effects of rain within 1 hr of applying other pesticides and of cultivation.

Caution See labels for maximum rates per application and season. Preharvest interval is 30 days.

Site of action Group 1: acetyl CoA carboxylase (ACCase) inhibitor

Chemical family Cyclohexanedione

dichlobenil (Casoron 4G)

Rate 4 to 6 lb ai/A (50 lb/A Casoron)

Time Apply to dormant rhubarb when temperatures are low and rain is expected immediately after application, to activate herbicide and prevent loss by volatility.

Remarks Provides residual control of summer annuals at 50 lb product/A; suppresses some perennials. Even coverage is important for good weed control. Inhibits cell wall production.

Caution Experience is lacking in the PNW with this product. Treat small areas initially.

Site of action Group 20: inhibits cell wall synthesis Site A.

Chemical family Nitrile

glyphosate (many products)

Rate Consult label

Time Broadcast before crop emerges; hooded and shielded sprayers in row middles, wiper application in row middles after crop emerges.

Remarks Can apply in winter or early spring before rhubarb shoots or leaves emerge. Over-the-top wipers and directed applications are not permitted once the crop emerges. Treatment with other selective equipment (hooded and shielded sprayers) must be 14 days before harvest.

Site of action Group 9: inhibits EPSP synthase

Chemical family None generally accepted

mesotrione (Callisto)

Rate 0.188 lb ai/A (6 fl oz/A)

Time Apply to dormant rhubarb before spring green-up.

Remarks Provides preemergence and postemergence weed control. Add crop oil concentrate at 1% v/v or nonionic surfactant at 0.25% to spray solution if weeds have emerged.

Caution Applying Callisto to non-dormant rhubarb may result in a temporary bleaching. Rain or irrigation after application may increase risk of injury to emerging rhubarb. Preharvest interval is 21 days. Do not exceed 6 fl oz/A or one application per year.

Site of action Group 28: inhibits 4-hydroxyphenylpyruvatedioxygenase (4-HPPD)

Chemical family Triketone

napropamide (Devrinol 50DF)

Rate 4 lb ai/A (8 lb/A)

Time Apply to weed-free soil surface in winter, to dormant rhubarb, before weeds begin to germinate. Inhibits root growth.

Site of action Group 15: inhibits very long chain fatty acid synthesis

Chemical family Acetamide

paraquat (Gramoxone Inteon, 2 lb paraquat cation/gal)

Rate 0.43 to 0.68 lb ai/A cation (1.7 to 2.7 pints/A)

Time Apply during dormant season before buds in crown begin to grow.

Remarks Add nonionic surfactant at 8 fl oz/100 gal spray mix. Acts as contact; absorbs energy produced by photosynthesis, forming peroxides that disrupt living cells.

Caution **A restricted-use pesticide.** Do not ingest or inhale spray mist. Wear protective face shields, respirators, and clothing. Add a nonionic surfactant or crop oil concentrate as on label; take care to avoid anionic formulations that form insoluble precipitates in the tank. Do not exceed two applications or 3 pints/A per season.

Site of action Group 22: photosystem I electron diversion

Chemical family Bipyridilium

pronamide (Kerb)

Oregon and Washington only

Rate 1 to 2 lb ai/A (2 to 4 lb/A)

Time Apply in fall or winter to established rhubarb for grass and chickweed control. Results are best if soil is below 55°F and rain or irrigation follows application.

Remarks Requires moisture from overhead irrigation or rain to activate. Inhibits root growth. Poor control of weeds in the Asteraceae (Composite) family.

Caution **A restricted-use herbicide.** Do not apply to newly transplanted rhubarb or to rhubarb that is actively growing. Preharvest interval is 38 days. Do not exceed 2 lb ai/A per year.

Site of action Group 3: microtubule assembly inhibitor

Chemical family Benzamide

S-metolachlor (Dual Magnum)

Rate 0.63 to 1.27 lb ai/A (0.66 to 1.33 pints/A)

Time Broadcast on soil surface before crop emerges.

Remarks Do not exceed 1.33 pints/A or one application per crop. Use lower rates on light-texture soils, higher rates on fine-texture soils. Dual Magnum will not control emerged weeds.

Caution Preharvest interval is 62 days.

Site of action Group 15: inhibits very long chain fatty acid synthesis

Chemical family Chloroacetamide

sethoxydim (Poast)

Rate 0.28 lb ai/A (1.5 pints/A)

Time Apply at optimum growth stage listed on label.

Remarks Identify susceptible grasses and add 2 pints/A nonphytotoxic crop oil concentrate to improve leaf absorption. Control often is erratic on grasses stunted or stressed from drought, heat, or low fertility. Resistant grasses include annual bluegrass and all fine fescues, but quackgrass can be suppressed.

Caution Do not mix or apply with any other pesticide, additive, or fertilizer except as specified on label. Preharvest interval is 30 days. Do not exceed 3 pints/A per season. Inhibits fatty acid production, cell membranes, and new growth.

Site of action Group 1: acetyl CoA carboxylase (ACCase) inhibitor

Chemical family Cyclohexanedione

Tomatoes, Peppers, and Eggplants

Ed Peachey

Revised December 27, 2009

TOMATOES, PEPPERS, AND EGGPLANTS— Pretransplant, Preemergence, or Post-directed

carfentrazone (Aim EC)

Transplants only

Rate Up to 0.031 lb ai/A (2 fl oz Aim EC)

Time Apply up to 1 day before transplanting.

Remarks Tank-mixes with other herbicides increase spectrum of control. Apply to actively growing weeds not more than 4 inches tall or rosettes 3 inches in diameter. Contact activity only. Coverage is essential for good control.

Caution Do not exceed 0.031 lb ai/A (2 fl oz Aim EC) per crop season.

Site of action Group 14: protoporphyrinogen oxidase inhibitor

Chemical family Triazinone

clomazone (Command 3ME)

Peppers only, but not on banana peppers

Rate 0.25 to 1 lb ai/A (0.66 to 2.66 pints/A). Use lower rates on coarse soil, higher rates on fine soils.

Time Preemergent soil-applied, before transplanting.

Remarks Place roots below the chemical barrier when planting. Do not use on banana peppers.

Caution Clomazone has a residual or carryover of up to 16 mo; therefore, consult label for rotational crops before applying. Do not apply next to sensitive crops when there is potential for drift. The microencapsulated (ME) formulation is designed to minimize drift and injury to adjacent fields and sites.

Site of action Group 13: inhibits DOXP synthase

Chemical family Isoxazolidinone

DCPA (Dacthal)

Tomatoes only

Rate 4.5 to 10.5 lb ai/A (6 to 14 lb/A)

Time Apply 4 to 6 wk after transplanting to moist, weed-free soil; apply more water to activate.

Remarks Performs poorly in western Oregon and Washington. Consult label for planting sensitive crops within 12 mo. Results can be improved with overhead irrigation immediately after spraying. Inhibits mitosis.

Site of action Group 3: microtubule assembly inhibitor

Chemical family Phthalic acid

halosulfuron (Sandea)

Pretransplant in tomatoes only, including under plastic mulch

Rate 0.375 to 0.75 oz ai/A (0.5 to 1 oz/A)

Time Pretransplant applied to bare ground with transplanting 7 days later.

Remarks Controls nutsedge and may be used under plastic mulch. Make a second postemergence application if nutsedge breaks through the plastic.

Caution Sandea-treated soil in transplant hole may injure crop. Note crop rotation intervals.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

napropamide (Devrinol)

Rate 1 to 2 lb ai/A (2 to 4 lb/A)

Time Apply and incorporate uniformly 1 to 2 inches deep before transplanting. Use lower rates on light, sandy, or coarse soils.

Remarks After harvest, plow deeply with moldboard or disk plow before planting succeeding crops. Inhibits seedling roots.

Site of action Group 15: inhibits very long chain fatty acid synthesis

Chemical family Acetamide

pendimethalin (Prowl H2O only)

Rate 0.475 to 1.43 lb ai/A (1 to 3 pints/A) depending on soil type.

Time Preplant incorporate before transplanting; preplant surface before transplanting; or post-directed application to transplanted or established direct-seeded tomatoes and peppers.

Remarks Spray only once and avoid overlaps. Use lower rates on light or coarse soils low in organic matter. Consult label for planting crops within 12 mo. Direct sprays to soil beneath transplants if applying postemergence. Inhibits mitosis, primarily in shoots. Preharvest interval is 70 days.

Caution Do not apply to direct-seeded tomatoes or over the top of tomatoes or peppers, as injury will be severe. Consult crop injury disclaimer on label before using.

Site of action Group 3: microtubule assembly inhibitor

Chemical family Dinitroaniline

S-metolachlor (Dual Magnum, Charger Basic, or Brawl)

Supplemental label; tomatoes only

Rate 0.95 to 1.9 lb ai/A (1 to 2 pints/A) depending on soil texture and organic matter content

Time Pretransplant incorporated, pretransplant on the surface, or postdirected to transplanted tomatoes at least 4 inches tall.

Remarks If applied pretransplant, incorporate but to less than the depth of transplanting. Postdirected applications to transplanted tomatoes should be after the first irrigation or settling rain.

Caution Do not apply to varieties or cultivars with unknown tolerance to Dual Magnum. Dual Magnum may damage transplants weakened for any reason. Do not plant under wet, cool, or unfavorable growing conditions. Preharvest interval is 90 days.

Site of action Group 15: inhibits very long-chain fatty acid synthesis

Chemical family Chloroacetamide

S-metolachlor (Dual Magnum)

Transplanted bell peppers, Oregon only

Rate Before transplanting: 0.48 to 0.96 lb ai/A (0.5 to 1 pint/A Dual Magnum); after transplanting: 0.96 to 1.6 lb ai/A (1 to 1.67 pints/A Dual Magnum). Use lower rates on coarse soil and higher rates on fine-texture soil. In most Willamette Valley soils, if used according to label, 1 pint/A gives acceptable weed control with minimal phytotoxicity concerns.

Time Before and after transplanting (do not incorporate).

Remarks Special local needs label OR-070004. Transplanted bell peppers are very tolerant to over-the-top broadcast applications of *S*-metolachlor. Do not add adjuvants of any kind. Will not control emerged weeds; till the soil 2 to 3 days before applying to destroy weeds that may have emerged. Weed control is best if applied after transplanting and if about 0.5 inch of irrigation water is applied shortly after transplanting (up to 2 days). Excessive water will lessen weed control.

Caution Ensure that *S*-metolachlor-treated soil is not concentrated near bell pepper roots during transplanting, by minimizing the amount of *S*-metolachlor-treated soil allowed into the furrow during planting. *S*-metolachlor may injure crops if plant roots directly contact treated soil. Muck soils (more than 20% organic matter) normally require the higher rate (1 pint/A); however, weed control may be reduced on muck soils. *S*-metolachlor may injure crops if plant roots directly contact treated soil. Apply only once per crop; do not exceed 1 pint/A. Do not apply and incorporate *S*-metolachlor before transplanting. Preplant-incorporated applications may injure the crop. Do not apply to direct-seeded crops. Tank-mixing with other herbicides may increase the chance of crop injury. Preharvest interval is 60 days.

Site of action Group 15: inhibits very long-chain fatty acid synthesis

Chemical family Chloroacetamide

trifluralin (Treflan)

Rate 0.5 to 1 lb ai/A (1 to 2 pints/A) depending on soil type and crop

Time Apply before transplanting peppers and before or after transplanting tomatoes or eggplant. Incorporate within 24 hr by cross-disking or by using a power take-off (PTO) rotary tiller.

Remarks Spray only once and avoid overlaps. Use lower rates on light or coarse soils low in organic matter. Consult label for planting crops within 12 mo. Direct sprays to soil beneath transplants if applying postemergence. Inhibits mitosis, primarily in shoots.

Site of action Group 3: microtubule assembly inhibitor

Chemical family Dinitroaniline

TOMATOES, PEPPERS, AND EGGPLANTS—Postemergence

clethodim (Prism or Select)

Rate For tomatoes, 0.094 to 0.188 lb ai/A (6 to 12 oz/A Select); for peppers and eggplants, 0.094 to 0.125 lb ai/A (6 to 8 oz/A Select). Also depends on weed growth stage.

Time Apply to actively growing grass weeds, including annual bluegrass, at growth stage as on label.

Remarks Consult labels for maximum rates per application and season. Read label carefully for adjuvant instructions and for information about effects of rain within 1 hr, applications of other pesticides, and cultivation. Preharvest interval is 20 days.

Site of action Group 1: acetyl CoA carboxylase (ACCase) inhibitor

Chemical family Cyclohexanedione

halosulfuron (Sandea)

Broadcast only in tomato; row middles and furrows for peppers and eggplants

Rate 0.375 to 0.75 oz ai/A (0.5 to 1 oz/A)

Time Apply broadcast to actively growing transplanted tomatoes with four leaves or more, 14 days or more after transplanting, but before first bloom. Apply to row middles or furrows only in direct-seeded peppers and eggplants, avoiding herbicide contact with the planted crop.

Remarks Will not suppress or control nightshade species.

Caution Observe crop rotation restrictions carefully.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

metribuzin (Sencor)

Tomatoes only

Rate 0.25 to 0.5 lb ai/A (0.5 to 1 pint/A)

Time Preplant incorporate before transplanting; or apply postemergence as a single treatment or a split application, with at least a 14-day interval, at 0.25 to 0.37 lb ai/A to tomatoes with at least five to six true leaves but before weeds are 1 inch tall.

Remarks Use lower rates on soils with 0.5 to 2% organic matter, but do not use on soils with less than 0.5% organic matter. Inhibits photosynthesis.

Caution Do not use surfactant or tank-mix with other pesticides. Do not apply within 24 hr of other pesticide applications. Preharvest interval is 7 days. Do not apply within 3 days after cool, wet, or cloudy weather. Do not exceed 1 lb ai/A per season. Carefully note other precautions on label.

Site of action Group 5: photosystem II inhibitor

Chemical family Triazinone

metribuzin (Lexone or Sencor)

Established tomatoes only

Rate Directed spray at 0.5 to 1 lb ai/A

Time Apply as a single treatment or a split application with at least a 14-day interval when weed pressure is intense, or in fields with hard-to-control weeds.

Caution Do not exceed 1 lb ai/A per season. Note other precautions above and on label.

Site of action Group 5: photosystem II inhibitor

Chemical family Triazinone

paraquat (Gramoxone Inteon, 2 lb paraquat cation/gal)

Rate Preplant and preemergence: 0.43 to 0.68 lb ai/A cation (1.7 to 2.7 pints/A Inteon). Postemergence directed: 0.43 lb ai/A cation (1.7 pints/A Inteon).

Time Apply as a directed spray to emerged weeds between rows after crop is established.

Caution Do not exceed three applications per season. Preharvest interval is 30 days. Do not graze animals.

Site of action Group 22: photosystem I electron diversion

Chemical family Bipyridilium

rimsulfuron (Matrix)

Field-grown tomatoes only

Rate 0.25 to 0.5 oz ai/A (1 to 2 oz/A) postemergence

Time Apply when weeds are less than 1 inch tall or wide and crop is at the cotyledon stage.

Remarks Use a nonionic surfactant at 0.25% v/v. Sequential applications 7 to 14 days apart may improve black nightshade control. Tomato varieties may differ in tolerance to rimsulfuron; apply to a small test area before treating whole fields.

Caution Using adjuvants at more than 0.25% v/v may result in temporary chlorosis. Consult labels for rotational intervals. Preharvest interval is 45 days.

Site of action Group 2: acetolactate synthase (ALS) inhibitor

Chemical family Sulfonylurea

sethoxydim (Poast)

Rate 0.28 lb ai/A (1.5 pints/A)

Time Apply at optimum growth stage listed on the label.

Remarks Identify susceptible grasses and add 2 pints/A nonphytotoxic crop oil concentrate to improve leaf absorption. Control often is erratic on grasses stunted or stressed from drought, high heat, or low fertility. Resistant grasses include annual bluegrass and all fine fescues; quackgrass can be suppressed.

Caution Preharvest interval is 20 days. Do not exceed 4.5 pints/A per season. Inhibits fatty acid production, cell membranes, and new growth.

Site of action Group 1: acetyl CoA carboxylase (ACCase) inhibitor

Chemical family Cyclohexanedione