

**YAMHILL COUNTY
ROADSIDE VEGETATION
MANAGEMENT PLAN
TECHNICAL SUPPORTING DOCUMENT**

PART 1: Priority Invasive Plants With Recommended Control Measures

PART 2: Herbicides Labeled for Roadside Vegetation Management

Yamhill County Public Works Department



February 2016

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PART 1: PRIORITY NOXIOUS WEEDS AND INVASIVE PLANTS WITH RECOMMENDED CONTROL MEASURES

Working with the Roadside Vegetation Management Technical Advisory Committee, the Yamhill County Public Works Department identified the following priority invasive plants and noxious weeds that affect road operations and maintenance. Most species on the list are designated as noxious weeds by the Oregon Department of Agriculture, including weeds that are new or currently have limited distribution in Yamhill County and are known to be highly invasive. The list also includes plants that commonly cause sight distance or line of sight problems for road users or that encroach onto the roadway and/or shoulders. These plants are not Oregon natives except for poison oak, which is included because of its high dermal toxicity. The list will be regularly reviewed and updated; this does not preclude the addition of a new invasive plant prior to this review, nor does it prevent the PWD from taking timely action to control a new invasive species.

Control measures include mechanical/manual and chemical options. An expanded discussion on chemicals is included as Part 2 of this document. The control measures described here are taken from research and information published by recognized authorities, including Oregon State University Extension Service, other university extension services, US Forest Service, Bureau of Land Management, and The Nature Conservancy. Chemical control recommendations are taken also from the labels of herbicides that are approved for use on roadside rights-of-way by the Environmental Protection Agency (EPA). When applying herbicides, always read and follow the instructions on the label. By law, herbicides cannot be used on other sites or at higher rates than those listed on their labels, and the information provided here is not intended to substitute for that on the label. Since control measures are subject to change as more research is done and/or new products or control methodologies become available, the information provided in this document does not preclude Yamhill County PWD from using new chemicals as they become available, nor does it require the PWD to use chemical controls when other control methods (e.g., manual/mechanical) are sufficient.

Detailed control measures are included for the following:

1. Garlic mustard (*Alliaria petiolata*) - a high priority for eradication or containment
2. Knotweed (*Polygonum spp.*)
3. Scotch broom (*Cytisus scoparius*)
4. Himalayan blackberry (*Rubus armeniacus*)
5. Poison oak (*Toxicodendron diversilobum*)
6. Bull thistle (*Cirsium vulgare*) and Canada thistle (*Cirsium arvense*)
7. Common teasel (*Dipsacus fullonum*)
8. Reed canarygrass (*Phalaris arundinacea*)
9. Bamboo

MANAGING HERBICIDE RESISTANCE

When a single method of control is used over and over (whether it be mechanical/manual or chemical), weed populations will change (shift), and weeds that are more tolerant to a specific practice will begin to dominate the site. Continual use of the same herbicide will select for individual weeds that are resistant to that herbicide. For long-term weed control, methods should be rotated or combined to avoid weed shifts and herbicide resistance. Chemical control should include more than one herbicide, each having a different mechanism of action in the plant; when possible, control should include non-herbicide methods as well.

Further information about managing weed resistance and about the properties of specific herbicides is included in Part 2 of this document. Trade names (brand names) of some commercial herbicides are mentioned to help identify the common chemical name. This information does not imply endorsement of the product or discrimination against products not mentioned.

No biological controls are currently available for these priority noxious weeds and invasive plants. There is an insect available that reduces seed production of Scotch broom, but it does not remove existing plants.

PRIORITY PLANTS, ISSUES, AND CONTROL MEASURES

Garlic mustard (*Alliaria petiolata*)

Issues:

- Currently found in only one known location in Yamhill County, this is a highly invasive plant. It is a major problem in Hood River, Multnomah, Columbia, and Clackamas counties.
- Each plant produces hundreds of small seeds that can be easily carried by water, as well as humans, vehicles, and animals. It dominates in forests but is adaptable to many environments, including roadside ditches.
- A biennial plant, it forms a basal rosette of leaves the first year and sends up a flower stalk (bolts) producing seeds in the second year. It begins growth in spring at low temperatures, earlier than many other plants.
- Preventing seed production from mature bolted plants should be the primary focus of control measures.
- After working in any area where this plant is suspected, boots, clothing, equipment, and vehicles should be cleaned to avoid transporting seeds.



Control Actions:

- Mechanical/Manual:
 - Hand-pulling plants can be very effective when soil is loose. The best time to pull is during bolting; second year/pre-bolting rosettes have a stout root that can be difficult to extract. Beginning around May, a bolted plant can be pulled effectively if grasped by the "S-shaped" root crown. However, plants that snap off at the base may have enough nutrient stores to re-bolt, flower, and set seed in the fall or the following year. Aggressive hand-pulling is recommended for all small, newly established (satellite) infestations.
 - Bolted plants will complete flowering and set seed after they are pulled, so it is important to bag them and dispose of the bags in a landfill or by burning.
 - Mowing should be avoided when seeds are mature. Mowing will not control garlic mustard effectively unless it is repeated throughout the growing season. Although mowing will kill a high percentage of plants, older plants are able to re-sprout and flower again in the same season. Mowing also can damage desirable vegetation, thus allowing garlic mustard to spread.
- Chemical:
 - Apply a 1.0 to 3.0% solution of glyphosate, with the addition of 1.0% by volume of either a nonionic or a modified crop oil surfactant, as a foliar spray either in spring prior to flowering or in late fall. To control seedlings and rosettes, a 1.0 to 2.0% solution is adequate; the higher rate should be used on plants that have bolted. Glyphosate will not affect garlic mustard plants that are well into or beyond flowering stage. These plants will have time to develop mature seed before the chemical stops their growth. An application done in very early spring avoids desirable species that have not yet emerged.
 - Apply a 1.0 to 1.5% solution of triclopyr, with the addition of 1.0% by volume of either a non-ionic or a modified crop oil surfactant, as a foliar spray any time plants are actively growing. Triclopyr may be more effective than glyphosate on already-flowering plants.
 - Metsulfuron as a foliar spray is effective at a rate of 0.5 to 1.0 ounces of product/acre applied in spring or fall. It may be used alone or used in a tank-mix with either glyphosate or triclopyr, each at its labeled rate.

Knotweed (Japanese, Bohemian-hybrid, Giant, Himalayan) (*Polygonum spp.*)

Issues:

- Knotweed currently has a relatively limited distribution in Yamhill County, so it is important to control the plant from spreading further.
- It is a perennial that produces a mass of rhizomes with a dense stand of canes up to 10 feet tall. It spreads rapidly by vegetative reproduction



Japanese knotweed

(seeds are mostly non-viable). Root and stem fragments as small as ½ inch can form new colonies.

- It grows best along rivers and creeks, but will persist in drier areas. It spreads primarily by stem and rhizome pieces broken off during flood events, but can also be spread by earth-moving equipment and in contaminated fill material.

Control Actions:

- Mechanical/Manual:
 - For large patches, cut knotweed stems to ground level at least twice a month between April and August, then once a month until the first frost to starve the root system. If patches are well established, this must be kept up for 2 to 3 years, never allowing the knotweed stems to reach full extension.
 - Digging alone can be successful on very small patches, but only if all the roots and rhizomes are removed. Digging is not recommended for larger patches because it is difficult to remove all rhizome fragments.
 - Knotweed will resprout vigorously following cutting or digging. Check for new sprouts up to 20 feet away from the original patch.
 - Dispose of cut material in a landfill. Cut stems and root fragments will readily regenerate new plants from buds if they touch soil, and pieces can stay alive for months.
- Chemical:
 - Apply a 1.5 to 2.0% solution of glyphosate or a 2.0% solution of triclopyr as a foliar spray to actively-growing plants at the flowering stage. Plants should be thoroughly wet, but not dripping. Add an appropriately labeled surfactant at 0.5% by volume. Using an indicator dye will help with achieving complete, uniform coverage. A second treatment in the fall will improve control. Treatments are usually needed for 2 to 3 years. Because knotweed may be more than 10 feet tall when it begins to flower, waiting until the ideal time to spray may not be practical. Cutting 1 or 2 times in spring and summer, then spraying the regrowth again in the fall, is also an effective treatment. Triclopyr is slightly more active on knotweed than glyphosate.
 - Imazapyr is more active than either glyphosate or triclopyr on knotweed and is the best choice for large, dense infestations. This treatment may reduce the number of retreatments required to control the infestation. However, it should only be used on sites where no desirable plants are present. (A rule of thumb is to avoid application within a distance equal to the height of sensitive trees.) Apply a 1.0% solution of imazapyr as a foliar spray with at least 0.25% surfactant by volume. The effective rate is 3 to 4 pints/acre. Apply when plants are actively growing from midsummer until the first killing frost. Plants should be thoroughly wet, but not dripping. Do not exceed the maximum rate of 6 pints/acre/year. Addition of a surfactant is required. This can be either a nonionic surfactant at 0.25% by volume, or a methylated seed oil or crop oil concentrate at 1.0% by volume.
 - Glyphosate or triclopyr can be used as a cut stem application. Cut the stem about 2 inches above ground level. Immediately apply a 25.0% solution of glyphosate or triclopyr and water to the cross-section of the stem. A subsequent foliar application may be required to control new seedlings and resprouts.

- Glyphosate can be used full-strength as a hollow stem injection treatment. Inject 6 ml per stem of glyphosate between second and third internode using a hand-held injection device that delivers the recommended amount. For plants growing in an aquatic site, inject 5 ml per stem using a glyphosate product with an aquatic label (these products have a higher concentration of glyphosate). The combined total for all treatments must not exceed 8 quarts of product per acre. At 5 ml per stem, 8 quarts should treat approximately 1500 stems. A marking pen can be attached to the tool to avoid repeated applications.

Scotch broom (*Cytisus scoparius*)

Issues:

- This is a highly aggressive shrub that grows up to 12 feet tall and creates a dense monoculture, crowding out native plants. The plants are extremely flammable. A single plant can produce over 10,000 seeds/year and can throw seed up to 20 feet from the plant; seeds can remain viable in the soil for as long as 40 years.
- It severely reduces line of sight for drivers, and creates hazards for equipment operators by obscuring roadside facilities, such as meter boxes and pole guywires. It is difficult to control within County road rights-of-way because it heavily infests adjacent private property, often obscuring private fence lines.
- Scotch broom has attractive yellow flowers, so it is important to educate the public that broom is an invasive species that should be controlled.



Control Actions:

- Mechanical/Manual:
 - Ideally, to prevent seed spread, mechanical or manual removal of Scotch broom plants should be done between flowering and seed pod maturation.
 - Pulling plants is labor-intensive but effective. Smaller plants can be pulled by hand or with a Weed Wrench. However, pulling can disturb the soil and create ideal conditions for broom seed germination, so control measures for the regrowth later will be necessary. Reestablishing vegetation, such as grasses, on the site as soon as possible reduces broom seedling survival.
 - Cutting can be effective, especially on older plants that are no longer green at the base. Cut as close to the ground as possible. The best time to cut is mid-July to September when plants are stressed from summer drought and are less likely to resprout. However, plants should be cut before pods have matured and released their seeds.
 - Mowing alone is not as effective as other methods and will need to be repeated throughout the season or combined with other methods. Early season mowing typically results in dense, multi-stemmed regrowth, especially with younger plants.

Mowing in the spring, followed by a fall herbicide application once plants have regrown, is effective.

- Chemical:
 - Apply a 1.5 to 2.0% solution of glyphosate as a foliar spray to actively growing plants in spring before blooming. Foliage must be thoroughly wet for effective control. Use a non-ionic surfactant to improve coverage. This treatment is also effective in the fall. It is not effective when plants are under drought stress in the summer. Note that glyphosate also controls grasses and other desirable plants, and bare ground is an ideal place for new broom seedlings to germinate. Thus, ideally, a treatment program should include a plan for reestablishing vegetation on the treated area.
 - Apply a 1.0 to 1.5% solution of triclopyr amine as a foliar spray any time of year when the plants are actively growing. Foliage must be thoroughly wet for effective control. Use a nonionic surfactant to improve coverage. Use the higher rate for large plants and/or when plants are under drought conditions. Triclopyr will not kill a grass understory that helps prevent broom seedling establishment and reduces soil erosion.
 - Glyphosate or triclopyr amine, either full-strength or diluted up to 50% with water, may be applied to freshly cut (within 5 minutes) surfaces of stumps and stubs. It is especially important to wet the cambium layer (inner bark). This treatment is labor-intensive, and has nearly zero potential for injuring off-target plants.
 - Aminopyralid (*Milestone*) is effective on Scotch broom at 7 ounces/acre. Aminopyralid can also be added to tank mixes with other herbicides, such as glyphosate and triclopyr, each at its labeled rate to improve control on Scotch broom. A pre-mixed combination of triclopyr and aminopyralid (*Milestone VM Plus*) is effective on Scotch broom at 6 to 9 pints/acre. A nonionic surfactant should be added for best results. Avoid overspray onto areas that may be cropped with sensitive species, such as clover or tomatoes, because the half-life of this product is very long.
 - Metsulfuron is effective on Scotch broom at a rate of 1.0 to 2.0 ounces/acre. It may be used alone, but is best used in a tank-mix with either glyphosate or triclopyr, each at its labeled rate.
 - Triclopyr ester, diluted to 20% with oil, is effective for basal bark applications any time of year, but is best used in the winter because esters are volatile and likely to drift in warmer temperatures. For stems less than 6 inches in basal diameter, spray the basal parts to a height of 12 to 15 inches from the ground, thoroughly wetting the entire lower stem including the root collar.
 - Treat new Scotch broom seedlings annually.

Himalayan blackberry (*Rubus armeniacus*)

Issues:

- Himalayan blackberry is the most abundant invasive plant in the Willamette Valley, including Yamhill County. It



encroaches on travel lanes, reduces line of sight for drivers, and creates hazards for equipment operators by obscuring facilities, such as meter boxes and pole guywires.

- Blackberries reproduce by sprouting from the roots and cane tips, as well as by seed. A plant produced from a cane tip grows more vigorously than a seedling. The shrub can grow over 10 feet high, with individual canes extending as much as 23 feet in a single season, and can produce up to 1,200 seeds/square foot.
- The canes are biennial: first-year canes develop from buds at or below the ground and produce only leaves; second-year canes grow from the leaf axils of the first-year canes and produce both leaves and berries. After the second year, the canes typically die and provide a supporting structure for live canes that sprawl over them.

Control Actions:

- Mechanical/Manual:
 - Mow canes to ground level repeatedly, at least twice a year, in June and September. Mowing to prevent seed production may be useful to slow the spread.
 - For small patches, digging out the roots and crowns is effective. However, new seedlings will readily sprout in soil disturbed by digging.
- Chemical:
 - Triclopyr is very active on blackberry. Apply a 2.0 to 3.0% solution as a foliar spray any time during the period of active growth after full leaf expansion in the spring. Under optimal conditions, when the sprayer can achieve good coverage of the foliage and when there is moisture in the soil, a 1.25% solution is adequate.
 - Glyphosate applied as foliar spray in a 2.0% solution is effective, but only in the fall (when the plant's food reserves are moving to the roots and the herbicide will be translocated with them). Foliage must be thoroughly wet for effective control. Spraying at other times of year will result in a burn or top kill only. The addition of a surfactant will improve effectiveness.
 - Metsulfuron applied as a foliar spray at a rate of 0.5 to 1.0 ounces of product/acre is effective. A foliar application can be made from full leaf extension in the spring until fall. Good coverage is essential to achieve control. It may be used alone or used in a tank-mix with either glyphosate or triclopyr, each at its labeled rate.
 - A combination of aminopyralid plus metsulfuron (*Opensight*) is effective at 2.0 to 3.0 ounces of product/acre. Apply when leaves are fully expanded; application after bloom and before frost is optimal.

Poison oak (*Toxicodendron diversilobum*)

Issues:

- Poison oak covers roadside utility vaults, climbs poles, guywires, and other roadside structures, and can block sight distance on roads.
- Oils from the plant cause inflammation, severe itching, and blistering in most people. Extensive contact with its leaves or stems can require hospitalization.
- Poison oak is an Oregon native that can grow



as a dense shrub up to 13 feet tall in open sunlight or as a vine more than 30 feet long in shaded areas. It reproduces by rhizomes and seeds.

Control Actions:

- Mechanical/Manual: Handling poison oak is not recommended.
- Chemical:
 - Apply a 1.0 to 1.5% solution of triclopyr amine as a foliar spray any time the plants are actively growing. Foliage must be thoroughly wet for effective control. Use the higher rate for large plants and/or in summer when plants are under drought conditions. Use a non-ionic surfactant at 2.0% by volume to improve penetration, as poison oak leaves have a thick waxy cuticle.
 - For improved control, aminopyralid can be added to tank mixes with other herbicides at their labeled rates. The maximum rate of aminopyralid is 7 fluid ounces/acre/year.
 - Metsulfuron is effective as a foliar spray at 1.0 to 3.0 ounces of product/acre in spring from full leaf expansion until the development of fall color. Foliage should be thoroughly wet for good control. The use of a non-ionic surfactant is recommended at a minimum rate of 0.25% by volume. Certain types of surfactants, such as those that include acetic acid (i.e. LI-700) may not be compatible, and may result in decreased performance. Metsulfuron can also be added to tank mixes with other herbicides, each at its labeled rate.
 - Metsulfuron may be applied as a spot treatment. Mix 1 gram of product/gallon along with a nonionic surfactant. Spray to the point of wetting the entire surface of the target plants, approximately 40 gallons of solution/acre. At this rate, 1 ounce of metsulfuron would make approximately 28 gallons of solution, and 0.1 ounce of metsulfuron would make 3 gallons.
 - A combination of aminopyralid plus metsulfuron (*Opensight*) is effective at 2.0 to 3.0 ounces of product/acre applied to actively-growing plants. Always add either a nonionic surfactant at 0.25% by volume or a crop oil concentrate at 1.0% by volume or methylated seed oil at 0.5% by volume.

Bull thistle (*Cirsium vulgare*) and Canada thistle (*Cirsium arvense*)

Issues:

- Both thistles are prolific producers of wind-blown seeds and are found almost everywhere in Yamhill County. They spread easily between County road rights-of-way and adjacent properties.
- Bull thistle is a biennial, which produces a rosette of leaves the first season, and flowers, sets seed, and dies the second season. It is relatively easy to control.
- Canada thistle is a creeping perennial that can live indefinitely. It has an extensive system of rhizomes and is more difficult to control than bull thistle. Mowing will hardly slow it down, and digging will leave broken pieces of rhizomes that can each form new plants, often increasing the size of the infestation.



Bull thistle



Canada thistle

Rhizomes are readily spread by earth-moving equipment and in contaminated fill material. Herbicides that translocate to the roots are the only effective method of control.

Control Actions:

- Mechanical/Manual:
 - Repeated mowing will reduce flowering and eventually kill bull thistle. Hand digging is effective for small patches. However, mowing and digging are not effective for controlling Canada thistle; digging will more likely increase the size of the infestation.
 - For both thistles, cutting the flowers and bagging them, then disposing of bags in a landfill or by burning, will reduce the spread of seeds.
- Chemical:
 - Glyphosate applied as foliar spray in a 2.0% solution is most effective when thistles are in the bud stage of growth and are actively growing (not under drought stress). Prior to the bud stage, when food reserves are moving upward from the roots, the herbicide will not be translocated to the roots, and it will kill only the top growth. This may be sufficient for controlling smaller bull thistles, but not for Canada thistle, which has an extensive root system. Treating regrowth again in the fall, when food reserves are moving into the roots, will improve control. However, by fall the plant has already dispersed seed, so it is most effective if flowers have been removed before they mature. Addition of a nonionic surfactant to improve spray coverage is recommended.
 - Triclopyr amine as a foliar spray in a 1.5% solution is effective on bull thistle any time during the growing season. However, it is most effective on Canada thistle in the bud stage and in the fall when food reserves begin moving to the roots. If sprayed at times other than these, Canada thistle may only be suppressed. The recommended rate is 0.33 to 1.5 gallon/acre. Use the higher rate when plants are under drought stress in the summer. To improve spray coverage, use with a non-ionic surfactant.
 - Aminopyralid is particularly effective on thistles. A nonionic surfactant at 0.25 to 0.5% enhances control under adverse environmental conditions. For bull thistle, apply aminopyralid at 3 to 5 fluid ounces/ acre in the spring and early summer to rosettes or bolted stems, or in the fall to seedlings and rosettes. Apply 4 to 5 fluid ounces/ acre when plants are at the late bolt through early flowering stages. For Canada thistle, apply aminopyralid at 5 to 7 fluid ounces/acre in the spring to plants in the prebud stage or in the fall to regrowth. Use the higher rate for older/dense stands or for longer residual control.
 - Metsulfuron is effective as a foliar spray on bull thistle at 0.5 to 1.0 ounces of product/acre for control and on Canada thistle at 1.5 to 2.0 ounces/acre for suppression only. Because of the likelihood of weed resistance, metsulfuron is best used in a tank mix with another herbicide, each at its labeled rate.
 - A combination of aminopyralid plus metsulfuron (*Opensight*) is effective on bull thistle at 1.5 to 2.0 ounces/acre in the spring and early summer to rosette or bolting plants, or in the fall to seedlings and rosettes. On Canada thistle, apply 2.0 to 3.3 ounces/acre in spring or summer when plants have emerged and are in the bud to early flower stage. Applications are also effective in the fall before a killing frost. Use the higher rate for older/dense stands. Always add either a nonionic surfactant at

0.25% by volume or a crop oil concentrate at 1.0% by volume, or a methylated seed oil at 0.5% by volume.

Common teasel (*Dipsacus fullonum*)

Issues:

- Teasel blocks sight distance on roads and spreads easily between County road rights-of-way and adjacent properties.
- It is a biennial that produces a flat rosette of leaves the first season, and flowers, sets seed, and dies the second season. Up to 7 feet tall, dead stalks filled with seeds can remain standing for several years.



Control Actions:

- Mechanical/Manual:
 - Hand digging is effective for small infestations.
 - Once the flowers start to appear on a stalk, plants may be cut at or just below the ground level. Plants that are cut too high prior to seed set are likely to regrow and set seed. Seed heads will mature on cut stalks, so all seed heads should be bagged after cutting and be burned or disposed in a landfill.
 -
 - Mowing standing plants after they have formed seeds will disperse the seeds and spread teasel. If standing dead plants are mowed, equipment should be cleaned before leaving the site.
- Chemical:
 - Apply triclopyr amine as a foliar spray in a 1.0 to 1.5% solution to actively growing plants in spring prior to flowering or to rosettes in the fall. Rosettes can be controlled with the lower rate. Use the higher rate for plants that have started to bolt. Since teasel is a biennial, plants that are well into or beyond the flowering stage will die anyway and drop their seed, so spraying at that time is not effective.
 - Apply metsulfuron as a foliar spray at the rate of 0.75 ounces of product/acre to actively growing plants. Adding a nonionic surfactant will increase effectiveness. Metsulfuron can also be used in a tank mix with triclopyr, each at its labeled rate. Because of the likelihood of weed resistance, metsulfuron is best used in a tank mix with another herbicide with a different site of action.
 - A combination of aminopyralid plus metsulfuron (*Opensight*) is effective at 2.0 to 3.0 ounces of product/acre applied to actively-growing plants. Add either a nonionic surfactant at 0.25% by volume or a crop oil concentrate at 1.0% by volume or methylated seed oil at 0.5% by volume.

Reed canarygrass (*Phalaris arundinacea*)

Issues:

- Reed canarygrass has become a serious invasive plant in wetlands. The stems are up to 6 feet tall and are so thick that, unlike most other grasses, the dead seed stalks will remain standing over the winter if the site is not mowed. The rhizomes and dead stems form a

dense layer (measuring almost 2 feet thick in established stands), which excludes most other plants.

- The plants produce abundant seeds that, along with rhizome fragments, spread in moving water. The grass tolerates being completely under water during the winter, and it will grow in up to 3 feet of standing water in the summer.
- Roadside ditches are a perfect habitat for reed canarygrass and are corridors for its spread.



Control Actions:

- Mechanical/Manual:
 - A new small infestation can be dug up, but eradicating an established infestation may require using heavy equipment to remove all the soil and roots. Continued monitoring and follow-up treatments may be required for 5 to 10 years.
 - If the infestation cannot be controlled, then mowing to prevent seed production will reduce the spread.
- Chemical:
 - Apply a 2.0% solution of glyphosate as a foliar spray before the seed head emerges (the boot stage) and up to when the seed head emerges with a surfactant added at 0.75 to 1.0% solution by volume. Reed canarygrass is very sensitive to glyphosate, and this application should be effective any time plants are actively growing. However, the ideal time for control is before they have produced seed. In spring, plants should be at least 18 inches tall or the herbicide is likely to kill only the above-ground parts. An established infestation will probably require applications over several years.
 - The aquatic formulation of glyphosate, diluted to 33.0% with water, plus a nonionic surfactant labeled for aquatic use added at 10.0% by volume, can be applied using a wiper applicator. A small infestation with only a few plants can be treated by hand using chemical-resistant gloves and a small spray bottle. Because the concentration is so strong, plants will be killed as long as a little gets on most of the leaves. For a certain period in the spring, reed canarygrass is likely to be taller than other grasses, so this treatment can be selective if the herbicide is not allowed to drip on plants below. Addition of a foaming surfactant can help reduce dripping from a wiper applicator.
 - Imazapyr is more active on reed canarygrass than glyphosate, but in most cases using this herbicide is not worth the potential risk to non-target plants. Apply a 1.0% solution of imazapyr as a foliar spray, with surfactant added at least 0.25% by volume, to actively growing foliage. The effective rate of imazapyr is 3 to 4 pints/acre. Do not exceed the maximum rate of 6 pints/acre/year. This treatment should only be used on sites well outside the root zones of any desirable plants that can take up imazapyr from the soil.



Bamboo

Issues:

- Bamboo is a group of woody perennial grass species that live for many years and are planted as landscape ornamentals.
- Clumping bamboo does not tend to spread. However, spreading bamboo has vigorous, fast-growing rhizomes, and they can quickly encroach on roadsides when planted by private landowners near the road right-of-way.



Control Actions:

- Mechanical/Manual:
 - Cutting or digging bamboo is effective only when patches are small, less than 3 feet across. This material should be disposed of in a landfill.
 - Hand digging often results in further spreading of the patch because rhizome fragments in the soil will resprout.
- Chemical:
 - Glyphosate is effective when applied as foliar spray in a 2.0% solution in the fall, after bamboo has been cut to the ground in the spring and has been allowed to regrow in the summer. Cover foliage thoroughly just to the point of drip. Wait 10 to 14 days and reapply the glyphosate at the same rate. The following spring, dead vegetation can be removed. Repeat the procedure if any shoots reappear.
 - Apply a 1.0% solution of imazapyr, with a nonionic surfactant added at least 0.25% by volume, to foliage when plants are actively growing and before setting seed. Imazapyr can also be applied on regrowth; the more foliage present, the greater the herbicide uptake, resulting in greater root kill. The effective rate of imazapyr is 3 to 4 pints/acre. Do not exceed the maximum rate of 6 pints/year. This treatment should only be used on sites well outside the root zones of any desirable plants that can take up imazapyr from the soil.

PART 2: CHEMICALS LABELED FOR ROADSIDE VEGETATION MANAGEMENT

The purpose of applying herbicides along the roadside is to eradicate or reduce the growth of noxious weeds, invasive plants, sight-obstructing brush, and other undesirable vegetation. The herbicides listed in this section may be used by Yamhill County and include selective and non-selective, foliar-active, and pre-emergent (soil residual) chemicals. No restricted-use chemicals are included. The herbicide 2,4-D is not used by the County because of its risks to sensitive crops, such as wine grapes, that may be in close proximity.

HERBICIDE TOXICITY

For all herbicide products, the EPA examines the acute toxicity for six different types of exposure (oral, dermal, inhalation, eye irritation, skin irritation, and dermal sensitization). Each exposure type is assigned a toxicity category (high, moderate, low, or very low) and a required “signal word” is on the product’s label, corresponding to the highest toxicity level assigned to any of the six exposure types. The signal words, from high to low toxicity, are Danger, Warning, and Caution. No signal word is required for the very low toxicity category, but the label may use the word Caution. Additional wording under the signal word on the label describes the risks to human health. The results of dermal sensitization studies, which evaluate the potential for allergic contact dermatitis, do not affect the signal word but are mentioned if a risk exists.

EPA also classifies pesticides into five wildlife toxicity categories (very highly toxic, highly toxic, moderately toxic, slightly toxic, and practically non-toxic) based on studies for groups of wildlife (mammals, birds, fish and aquatic insects, and sometimes honeybees).

MANAGING HERBICIDE RESISTANCE

A resistant weed population will develop when the same herbicide, or different herbicides that have the same biochemical site of action (mechanism of action) in the plant, is used repeatedly over several years to control the same weed species in the same area. This happens because naturally-occurring biotypes (individuals of a species that are identical in appearance but have slightly different genetic compositions) survive herbicide application at doses that kill most susceptible individuals, and allow resistant individuals to survive and reproduce. With repeated use, resistant weeds, which initially appear as isolated plants or patches in a field, spread quickly and soon dominate the population and the soil seed bank. Subsequent applications of that herbicide will no longer be effective.

The most important best management practice for preventing, delaying, or managing herbicide resistance is to use more than one method of controlling weeds in an area. Either rotate in subsequent applications to an herbicide from a group with a different mechanism of action that will control the weed species, or use a tank mixture with herbicides from different groups. When

practical, rotate to a mechanical or manual method for controlling the weed. It is important to monitor treated weed populations for resistant individuals that have escaped treatment and that, if allowed to go to seed, will spread resistant biotypes. Prevent movement of resistant weed seeds to other areas by cleaning equipment and clothing, and by planting clean seed.

The Weed Science Society of America (WSSA) has developed a numbering system for classifying herbicides into groups according to their site of action. The number appears on the first page of many of the labels for the herbicide contained in a particular product (currently this is voluntary). Herbicides described in the following section fall into five groups: glyphosate (Group 9); triclopyr, aminopyralid, and aminocyclopyrachlor (Group 4); metsulfuron, imazapyr, and chlorsulfuron (Group 2); sethoxydim (Group 1); and indaziflam (Group 29). One herbicide, fosamine, is not grouped.

MANAGING HERBICIDE DRIFT

Herbicide drift is the movement of an herbicide in the air to an area where its application was not intended. Organic farm crops, nursery crops, grapes and specialty crops grown for seed are especially sensitive to several herbicides used in roadside spraying, adjacent farming, and residential applications.

There are two types of drift: particle drift and vapor drift.

- **Particle drift** occurs when spray droplets move with the air away from the target site. After wind speed and direction, spray droplet size is the most important factor influencing particle drift.
- **Vapor drift** occurs when the herbicide volatilizes (evaporates) and changes into gas. The vapor no longer falls as droplets; it goes wherever the air moves. Volatilization may occur after the herbicide has already landed on the target. Things that affect vapor drift are temperature and formulation. Ester (petroleum-based) formulations are more likely to drift than amines (water-based), because they volatilize at lower temperatures.

Management Practices to Reduce Drift

- **Use Larger Nozzles:** A nozzle tip with a small orifice (opening) produces small droplets, which give more uniform leaf coverage than large droplets, but take longer to fall to the ground and are therefore more likely to drift. For herbicides that are translocated—that is, they move inside the plant—large droplets give adequate spray distribution on the leaves. In contrast, contact herbicides kill only the parts of the leaf they touch. Good coverage is important here, so smaller-sized nozzles are necessary. Using the largest nozzle that will work given the travel speed of the spray equipment is a good drift-reduction practice.
- **Reduce Pressure:** Standard nozzles produce a wide distribution of droplet sizes, including driftable fines, which are droplets smaller than 200 microns (0.001 mm) that remain suspended and do not hit the target plant. Within the recommended pressure range for a given nozzle, as the pressure is increased, the droplet size decreases and the percentage of driftable fines increases. Setting the sprayer pressure at the lowest end of

the recommended range for the nozzles will reduce drift significantly. To provide a higher output, increase the nozzle size rather than increasing the pressure.

- **Use Drift-reduction Nozzles:** There are now excellent choices for drift-reduction nozzles that produce more uniform droplet sizes, create larger droplets at a given pressure, and also provide good spray distribution over a wide range of pressures. Standard nozzles use a simple design with a single orifice to regulate the flow of the spray solution and produce the spray pattern. A drift-reducing improvement adds a pre-orifice, a chamber inside the nozzle body, and a larger exit orifice. This lowers the pressure and can reduce the amount of smaller drift-prone droplets by more than 50 percent. Newer nozzle designs have added a turbulence chamber inside the nozzle to further reduce pressure and increase droplet size. Most recently, air induction (venturi) nozzles have an added port that draws air into the chamber to create even larger droplets with entrained air. Spray produced by a nozzle with pre-orifice, turbulence chamber, and air induction technology, such as the TTI Turbo TeeJet Induction nozzle, contains only a fraction of a percent of drift-prone droplets.
- **Operate Spraying Equipment to Avoid Drift Problems:** Operating a sprayer at slower speeds creates less air movement behind the sprayer and less drift. If the boom is set higher than the recommended height for the nozzle type and spacing, there will be more opportunity for air to blow spray droplets off target. A windscreen or shield around the sprayer that extends near the sprayed surface may reduce drift, but one that is improperly designed may create unexpected air currents and cause more drift. Sprayers should be calibrated and the nozzles checked for uniform spray pattern at least once a year. Worn nozzles should be replaced.
- **Be Aware of Wind and Weather:** Measure wind speed and direction before, during, and after herbicide application. Spraying when the air is moving very slightly (less than 5 miles per hour) is ideal. Air that is dead calm may indicate a temperature inversion, when warmer air is being held close to the ground by a colder layer above. This creates more potential for injury because any suspended droplets remain in a concentrated mass rather than being diluted by rising warm air and dispersing above the leave zone.
- **Be Aware of the Sensitive Surroundings:** Spraying when there is a slight wind (less than 5 miles per hour) away from sensitive areas is a good practice for reducing damage. If sensitive plants are downwind, delay spraying until the wind direction has shifted. Proper timing of herbicide application can also help avoid damage. For example, grapevines are especially sensitive to certain herbicides during the bloom period, when exposure can reduce fruit set and cause delayed ripening.
- **Avoid the Use of Ester Formulations:** Esters start to volatilize at temperatures as low as 70 degrees, and the higher the temperature, the more they volatilize. Amines do not volatilize significantly until temperatures reach 90 degrees. Although esters are better at penetrating thick plant cuticles, in most situations they have no advantage over amine formulations, especially if amines are used with a non-ionic surfactant.

PROPERTIES OF HERBICIDES LABELED FOR ROAD RIGHTS-OF-WAY

The following chemicals are available for use by Yamhill County for roadside vegetation management; their properties and effects on vegetation are described. Information was taken

from research and information published by recognized authorities, including Oregon State University Extension Service, other university extension services, US Forest Service, Bureau of Land Management, and The Nature Conservancy, and from the labels of herbicides that are approved for use on roadside rights-of-way by the Environmental Protection Agency (EPA). This information is subject to change as more research is done and/or new products or control methodologies become available. This list does not preclude Yamhill County PWD from using new chemicals as they become available, nor does it require the PWD to use chemical controls when other control methods (e.g., manual/mechanical) are sufficient.

Site of Action Group 9

Herbicides in this group inhibit the EPSP enzyme, which is essential to amino acid synthesis.

Glyphosate:

- Trade names *Roundup Pro* (4 lb/gal active ingredient), *Accord XRT* (5.4 lb/gal active ingredient), and others. These formulations contain surfactants.
- Trade names *Aquamaster*, *AquaNeat*, *Rodeo*, *Accord Concentrate*, and others (5.4 lb/gal active ingredient). These formulations without surfactants are labeled for aquatic use; a surfactant labeled for aquatic use is generally added at the time of application.

Glyphosate is a non-selective herbicide that kills most annual and perennial weeds. It is systemic, i.e., it is translocated throughout the plant, including to the root system, killing the entire plant and not just the top growth. Uptake is entirely through the leaves. The more foliage that is present, the more effective the control. For this reason, best control of most perennial weeds is obtained when treatment is made at later growth stages when the plants are approaching maturity and before fall dormancy, when food reserves are moving to the roots and the herbicide will be translocated with them. Early in spring, or if plants have recently been mowed, application should be delayed to allow for the growth of adequate leaf surface to receive the spray. Use a higher application rate within the recommended range when weed growth is dense, or when weeds are growing in an undisturbed area where the root system is extensive. Visible effects of treatment, a gradual yellowing and browning of the leaves, occur after 7 to 10 days on most perennial weeds. Extremely cool or cloudy weather at treatment time may slow down the activity of glyphosate and delay the effects.

Glyphosate binds strongly to soil particles, which prevents it from leaching into groundwater or being taken up through the roots of non-target plants. This characteristic makes it useful as a site preparation treatment prior to planting desirable native or ornamental species, which may be planted immediately after application to target weeds. To allow time for translocation of glyphosate to weed roots, the site should not be tilled or mowed for 7 days after treatment. Applying glyphosate to foliage covered with dust will reduce its effectiveness.

Glyphosate can be applied to cut stumps to prevent regrowth of woody vegetation. Apply the glyphosate (either undiluted or diluted up to 50% with water) to the cambium tissue (beneath the bark) of freshly cut stumps. It must be applied immediately after cutting (within 5 minutes) for optimum control. The treatment may be used any time of year except during a period of heavy

sap flow. A water-soluble colorant may be added to the solution as a means of indicating which surfaces have been treated.

Regarding human health effects, all glyphosate formulations are classified by EPA as very low toxicity. The chemical glyphosate by itself is practically non-toxic to mammals, birds, and fish. However, the surfactants that are contained in some formulations are toxic to aquatic invertebrates, and these products are not registered for aquatic use. Other formulations without surfactants are labeled for aquatic use, and may be applied to foliage emerging from or hanging over water. A surfactant labeled for aquatic use should be added to these to improve spray coverage. There is no glyphosate uptake if applied to water.

Site of Action Group 4

Herbicides in this group are synthetic auxins. They mimic the naturally-occurring plant growth hormone auxin and disrupt plant cell growth in the newly forming stems and leaves, causing leaf curling and distortion.

Triclopyr:

- Trade names *Garlon 3A* and others (3 lb/gal acid equivalent). Amine formulation labeled for aquatic use.
- Trade name *Garlon 4* and others (4 lb/gal acid equivalent). Ester formulation.

Triclopyr is a selective herbicide that kills broadleaf plants, including woody brush, but has little or no effect on grasses. It is absorbed primarily through the leaves, but also can be absorbed through the roots, and it is translocated throughout the plant. The amine formulation is water-based, and therefore is less volatile and less likely to drift off target in warm weather than the ester, or oil-based formulation. The ester formulation is better able to penetrate a waxy cuticle and is effective on plants such as poison oak and Himalayan blackberry in the winter when they are not actively growing. The amine formulation should be used with an added surfactant to improve penetration.

Triclopyr is degraded by soil microbes and by sunlight. The average half-life of triclopyr in soils is 30 days. In water, it disappears in 4 to 8 days. Movement off-site through surface or sub-surface runoff is possible, as it is relatively persistent and has only moderate absorption to soil particles. Triclopyr is one of the most commonly used herbicides against woody species in natural areas.

Triclopyr amine can be used as a cut stump treatment, applying it to a freshly cut stump or stem, either undiluted or diluted up to 50% with water. This control method is labor-intensive, but it reduces the possibility of damaging off-target plants to nearly zero. Triclopyr ester can be used as a basal bark treatment, spraying it on the basal parts of brush and tree trunks (less than 6 inches in diameter) to a height of 12 to 15 inches from the ground, by thoroughly wetting the lower stem including the root collar.

The ester formulation of triclopyr is classified by EPA as low toxicity to humans because it can cause moderate eye irritation. The amine formulation is classified as high toxicity, with the word

Danger on the label, because it can cause irreversible eye damage. Applicators must wear protective eyewear. Triclopyr is slightly toxic to mammals, birds, fish, and aquatic invertebrates. The amine formulation is labeled for aquatic use, while the ester formulation is not because it is moderately to highly toxic to fish and aquatic invertebrates.

Aminopyralid:

- Trade name *Milestone* (2.0 lb/gal acid equivalent).
- Trade name *Milestone VM Plus* (0.1 lb/gal acid equivalent aminopyralid and 1.0 lb/gal acid equivalent triclopyr amine).
- Trade name *Opensight* (a dry product, 52.5% acid equivalent aminopyralid and 9.45% active ingredient metsulfuron by weight).

Aminopyralid is a relatively new herbicide, registered in 2005. A key feature is that it controls weeds at low application rates. Since a small quantity could injure off-target plants, it should be applied only with a carefully calibrated sprayer and only when the potential for spray drift is minimal. Aminopyralid is more selective on broadleaf plants (i.e. it kills a more limited range of plants) than other synthetic auxin-type herbicides, such as triclopyr or 2,4-D. It is particularly effective in controlling plants in the sunflower family, such as thistles, and in the legume family, such as Scotch broom. It has little effect on grasses. Uptake is primarily through the leaves but also through the roots, and it is translocated throughout the plant. There is some residual soil activity to provide control of later-emerging broadleaf weeds.

The half-life of aminopyralid in soils ranges from 1 to 17 months with a typical time of 3.5 months. It is broken down by soil microbes and by sunlight. At greater depths, or in waterlogged soils with less oxygen or aquatic sediments, it breaks down more slowly. In surface water, it is broken down by sunlight in less than 24 hrs. Aminopyralid is soluble in water and does not bind strongly with soil particles, giving it the potential to leach through soils and contaminate groundwater. It should not be applied within the root zone of trees, which may take up the herbicide.

Aminopyralid is classified by EPA as very low toxicity to humans, and it is practically nontoxic to mammals, birds, fish, honeybees, and aquatic insects. Because it is not metabolized in the body of mammals, urine and manure from livestock that have grazed on aminopyralid-treated pastures can injure sensitive plants. Treated vegetation cannot be used for compost.

Site of Action Group 2

Herbicides in this group inhibit the ALS (acetolactate synthase) enzyme, preventing the synthesis of essential amino acids and thereby stopping cell division.

Metsulfuron:

- Trade names *Escort XP*, *Metsulfuron 60EG IVM*, and others (60% active ingredient by weight).

The product is a dispersible granule that is mixed with water and applied as a foliar spray to control broadleaf plants. It does not injure established grasses. It should be applied using a

sprayer equipped with an agitation system to maintain the suspension in the tank. The addition of a surfactant, at 0.25 to 0.5% by volume, is recommended to improve spray coverage.

Metsulfuron is absorbed primarily through the foliage and, to a lesser degree, by the roots. It is typically applied in spring when the plants are fully leafed out until fall when colors start to change (on deciduous species). Best results are generally obtained when metsulfuron is applied to foliage after emergence following winter dormancy, although it has some pre-emergence activity. Two to 4 weeks after application, leaf growth slows, followed by discoloration and tissue death. The final effects on annual weeds are evident from 4 to 6 weeks after application. The ultimate effect on perennial weeds and woody plants occurs in the growing season following application. Weeds and brush hardened off by cold weather or drought stress will not be controlled.

Metsulfuron is injurious to plants at extremely low concentrations. Non-target plants can be adversely affected by a small amount of drift or run-off. Applications made where runoff water flows onto agricultural land may injure crops. It is highly water-soluble and has the potential to move into surface water and groundwater. The half-life in soil ranges from 14 to 180 days, typically 30 days. It is stable in water at a neutral or alkaline pH; it degrades faster under acidic conditions where it has an estimated 3-week half-life.

Metsulfuron has low toxicity for dermal exposure and eye irritation, and very low toxicity for oral and inhalation exposures. It is practically non-toxic to mammals, birds, fish, bees, and aquatic invertebrates. It is broken down quickly and eliminated from the body of mammals.

Resistant weeds have appeared frequently with herbicides in Group 2, so metsulfuron should be used in a weed management program planned for avoiding herbicide resistance. To control resistant biotypes, it is commonly mixed in a tank with another broadleaf herbicide having a different site of action, and/or it is rotated in subsequent applications with another herbicide.

Imazapyr:

- Trade names *Arsenal*, *Habitat*, and others (2.0 lb/gal acid equivalent).

Imazapyr is a non-selective herbicide, used for controlling grasses, broadleaf weeds, and woody brush. It is readily absorbed through foliage and roots and is translocated rapidly throughout the plant. For maximum effectiveness, weeds should be actively growing, and the spray solution should include a surfactant, either a non-ionic surfactant, a crop oil concentrate, or a methylated seed oil. Imazapyr is relatively slow acting, does not readily break down in the plant and is, therefore, particularly good at killing large woody species. Treated plants will stop growing soon after treatment and become reddish at the tips, first in the youngest leaves. Symptoms may not be apparent in some plant species until 2 or more weeks after application. Complete kill may not occur for several weeks. Imazapyr is labeled for aquatic sites. It must be applied to emergent foliage of the target vegetation; it does not control plants that are completely submerged or that have a majority of their foliage under water.

Imazapyr is highly water-soluble and can be taken up through the roots of non-target plants, resulting in injury or death. A rule of thumb is to avoid applying imazapyr within twice the

dripline of a tree canopy. In soils, imazapyr is degraded primarily by microbes. The half-life in soil ranges from 1 to 5 months. Degradation is slower in high pH soils. In water, it is degraded by sunlight, with a half-life of 2 days.

Imazapyr has low toxicity for dermal exposure and very low toxicity for oral and inhalation exposure. It is practically non-toxic to mammals and birds and from slightly toxic to practically non-toxic to fish and aquatic insects.

More resistant weeds have developed to the ALS inhibitor herbicides than to other herbicide types, so this mechanism of action may be more susceptible to developing resistance. Thus, imazapyr should be used in a weed management program for avoiding herbicide resistance.

Site of Action Groups 4 and 2

This combination product contains herbicides in two groups, synthetic auxin growth-regulators (Group 4) and ALS enzyme inhibitors (Group 2).

Aminocyclopyrachlor + chlorsulfuron:

- Trade name *Perspective* - a dry product, 39.5% acid equivalent aminopyralid and 15.8% active ingredient chlorsulfuron by weight.

Perspective is a pre-mixed herbicide combination that is used on roadsides or other non-crop sites to control weeds such as Canada thistle, bull thistle, teasel, knapweed, poison hemlock, and puncture vine. It is often used to establish or restore desirable perennial grasses for site stabilization. These two herbicides may also be used individually:

Aminocyclopyrachlor is a newer herbicide, registered in 2010, that is similar to aminopyralid except that it is active on a somewhat broader spectrum of weed species. It kills only broadleaf weeds, and it does not harm grasses. It is soluble in water and persistent in the soil. These characteristics give it the ability to control weeds for the whole growing season, but also give it the potential to leach through the soil with water and to be taken up through the roots of trees that are adjacent to the application area. Conifer trees are particularly sensitive. Aminocyclopyrachlor has very low toxicity, and it is practically nontoxic to wildlife.

Chlorsulfuron is primarily active on broadleaf weeds, but it controls some grasses. Entry is through foliage or roots, and it translocates throughout the plant. It is usually applied post-emergent, but it also has pre-emergence activity. Treated plants cease growth quickly, but complete control may take several weeks. It is broken down by soil microbes; the half-life for chlorsulfuron ranges from 1 to 3 months in soil, with a typical half-life of 40 days. Breakdown is faster in moist soils and at higher temperatures.

Chlorsulfuron has low toxicity for dermal exposure and very low toxicity for oral or inhalation exposure. It is a mild eye and skin irritant. It is practically nontoxic to mammals, birds, fish, and aquatic invertebrates. Resistant weeds have appeared frequently with herbicides in Group 2, so chlorsulfuron is best used in a tank-mix with another broadleaf herbicide having a different site of action to help control resistant biotypes.

Site of Action Group 1

Herbicides in this group inhibit the ACCase (acetyl CoA carboxylase) enzyme, which is essential for the production of lipids used in building new membranes required for cell growth in grasses.

Sethoxydim:

- Trade name *Poast* (1.5 lb/gal active ingredient).

Sethoxydim is a systemic herbicide that is translocated throughout the plant. It kills many, but not all, species of grasses and can, therefore, be used to selectively control grass weeds growing in desirable grasses, such as fine fescues (including the Willamette Valley prairie native Roemer's fescue). It is most effective when weeds are small. A methylated seed oil or crop oil concentrate surfactant should always be added.

The average half-life of sethoxydim in soils is 4 to 5 days, but half-lives can range from a few hours to 25 days. On the soil surface, it is broken down in about 4 hours by sunlight. In the soil, it is broken down by microbes. It is water soluble and does not bind strongly with soils, but it has little potential for leaching into surface or groundwater because it is degraded so rapidly.

Sethoxydim is classified as low toxicity because it can cause moderate eye injury. It is practically non-toxic to birds, but moderately to slightly toxic to fish and aquatic species.

Broadleaf plants and some grasses with ACCase enzymes that are less sensitive to sethoxydim are naturally resistant to Group 1 herbicides. Thus, herbicide resistance can develop quickly in these populations, and sethoxydim should be used in a weed management program planned for avoiding herbicide resistance.

Site of Action Group 29

Herbicides in this group inhibit cellulose biosynthesis (CB inhibitors), which is essential for maintaining cell walls in plants.

Indaziflam:

- Trade name *Esplanade* (1.67 pound/gal active ingredient).

Indaziflam is a non-selective pre-emergent herbicide for controlling annual grasses and broadleaf weeds. It is used for maintaining the vegetation-free shoulders on paved roads. Because indaziflam is toxic to fish and aquatic invertebrates, it should only be used on roads where the ditches do not drain into streams, creeks, or other water bodies. It reduces the emergence of seedlings but generally does not control weeds that have emerged. It may be mixed with a post-emergent herbicide to control existing weeds. To be activated, indaziflam needs a minimum of 0.25 inches of rainfall prior to seed germination.

Indaziflam has low toxicity for oral and dermal exposure and very low toxicity for inhalation exposure. It is practically non-toxic to mammals and birds.

Organophosphate, not grouped with other herbicides

Fosamine:

- Trade name *Krenite S* (4 lb/gal active ingredient).

Fosamine spray directed to part of woody brush and trees will provide control only of the portion sprayed, resulting in a trimming effect. Treatment generally does not immediately affect deciduous woody plants, which retain normal foliage for the remainder of the growing season. However, bud growth the following year is inhibited. Fosamine is applied once/year from spring to early fall. Coniferous species treated with fosamine generally display visible symptoms soon following application.

A penetrating type oil-based surfactant or crop oil concentrate may be used with fosamine, mixed in the spray solution at a minimum concentration of 0.25% by volume. Microbes break down fosamine in soils, where the half-life is about 8 days. Fosamine is mobile in some soils, but because it does not last long in the environment, it has a low potential to contaminate groundwater.

Fosamine has moderate toxicity for dermal exposure, and it can cause moderate eye injury. It has low to very low toxicity for oral and inhalation exposure, and is practically non-toxic to wildlife.

Adjuvants

- Trade names *R-11*, *LI-700*, *Preference*, *X-77*, and *Competitor* are labeled for aquatic use.
- Trade names *Agridex* and *Activator 90* are not labeled for aquatic use.

Adjuvants (additives) are products commonly added to mixtures to improve herbicide performance, including:

- **Nonionic surfactants:** reduce surface tension between water droplet and leaf surface and allow the herbicide to spread and adhere to foliage.
- **Crop oil concentrates:** contain emulsified petroleum-based oils, plus some nonionic surfactant; increase herbicide penetration into waxy leaves and reduce surface tension.
- **Methylated seed oil:** the product of the reaction of a fatty acid (derived from seed oils) with methyl alcohol that provides improved leaf cuticle penetration over conventional crop oil concentrates, and is typically used at lower rates; usually contain emulsifiers and surfactants to improve spreading on and adherence to the leaf surface.

APPENDIX A: Yamhill County Roadside Vegetation Management Technical Advisory Committee

The Yamhill County Board of Commissioners appointed the Yamhill County Roadside Vegetation Management Technical Advisory Committee (TAC) to update policies and Best Management Practices to guide and assist the Yamhill County Public Works Department (PWD) to manage roadside vegetation in a consistent, conscientious, and cost-effective manner. The TAC reports to the Yamhill County Road Improvement Technical Advisory Committee (RIAC). Upon completion of its charge, the TAC provides recommendations to RIAC, who then make recommendations to the Board of Commissioners. The TAC met monthly from February 2014 through November 2015 to develop the Management Plan and supporting documents. All members participated in development of this technical document. Susan Aldrich-Markham was principal author of Part 2: Chemicals Labeled for Roadside Vegetation Management.

Committee Members

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