

Crop Profile for Nursery-grown Rhododendron and Azalea in Washington

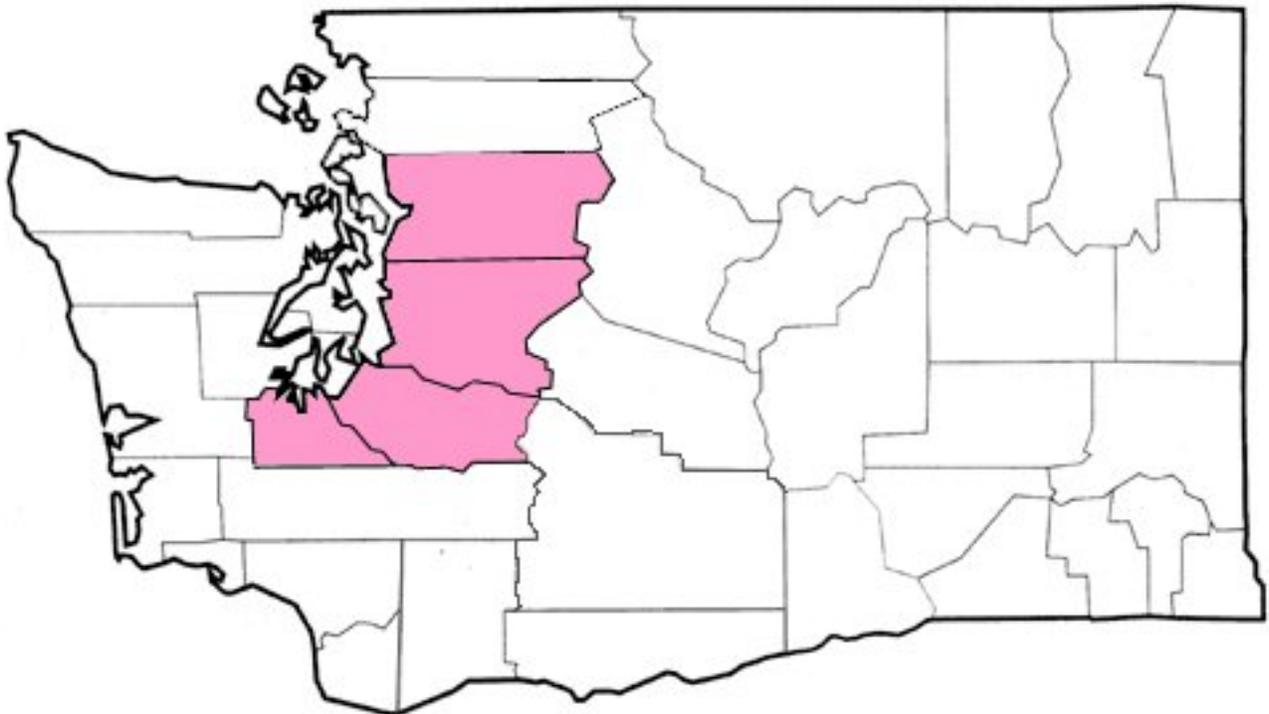
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General Production Information

- Annual gross sales for wholesale rhododendrons and azaleas in Washington State are approximately \$3.6 million.
- Approximately 4.3 million plants are produced in Washington State annually.
- There are six major producers of wholesale rhododendrons and azaleas in Washington State.
- Washington State ships wholesale rhododendron and azalea plants to retail growers throughout the United States, Canada, Europe and Japan. (8)

Production Regions

The majority of Washington rhododendron and azalea production takes place in King, Pierce, Snohomish, and Thurston counties, west of the Cascade Mountains.



General Information

The genus *Rhododendron* is comprised of species and hybrids commonly known as rhododendrons and azaleas. This plant genus can be traced back nearly 50 million years through fossils found in North America. The genus consists of about 1000 terrestrial species, varying from tiny mat-like plants 5 cm high to giant trees 24 m high or taller. They are among the most popular of all landscape plants. Rhododendron and azalea hybridizers register several new hybrids every year (3). They require moist, well drained, acidic soils with high organic content.



Healthy rhododendron bloom

Cultural Practices

Rhododendrons and azaleas are propagated from seeds, cuttings, or tissue culture. Initially, plants grown from tissue culture or cuttings are planted in groups into four-inch pots or liner beds. The plants are then placed in the greenhouse to harden off (e.g. allow tender green shoots to thicken their cuticle for sun and wind protection) before being moved outside to lath or shadehouses. After approximately one year, when plants are approximately two to two and one-half inches tall, with branches, the plants are transplanted into individual containers (pots). As the plants grow they are transplanted into successively

larger containers, such as one-gallon and five-gallon, and may be sold at that size. Alternatively, plants may be transplanted into the field and later sold with a burlap-covered root ball. Depending upon their markets, wholesale growers sell the plants as liners, containerized, or balled and burlapped plants. Rhododendrons sold in containers are two or more years old. Balled and burlapped rhododendrons are between two and four years old. Azaleas sold in containers range from two years old and up.

During December 1999, a survey was mailed to six wholesale producers that, together, represent the majority of nursery rhododendron and azalea production in Washington. The following information is based on the survey results. Insects were the primary pest problem, followed by diseases and weeds. Producers indicated that chemical choices were based on performance under their unique growing conditions.

Insects Pests

Obscure Root Weevil, *Sciopithes obscurus* And other root weevils including *Otiorhynchus* spp.

Growers identified root weevils as their most significant insect problem. Marginal notching of leaves indicates root weevil damage. This damage is caused by adult weevils, which are black to brown, each with a dark brown wavy line across its back. The larval stage of the weevil is found in the soil and feeds on the bark of the lower trunk and on plant roots. Adult control should begin when adults emerge during late May to June. Larval control is most effective when performed in the fall (2,5).



Root weevil is a major pest



Notched leaves indicate weevil damage

Controls

Cultural

A listing of hybrid rhododendron varieties and rhododendron species resistant to feeding by adult weevils is available through Washington State University Extension (1). Most notable is the species *R. davidsonianum* which also shows resistance to *Phytophthora*, and *R. yakushimanum*, which also shows resistance to powdery mildew. Hand picking weevils from plants during night feeding activity will reduce adult weevil populations in a small landscape, but is not economically feasible for large-scale commercial production.

Biological

Beneficial nematodes are available for control of the larvae. Nematodes may be used to supplement a well-developed integrated pest management (IPM) program using chemical and cultural management strategies. They are currently not used in large-scale commercial production. Nematode products include

BioSafe, Biovector, and Nemesis. They are applied to the soil during late spring to fall months when larval pests are present and soil temperatures are warm.

Chemical

Acephate (Orthene Turf, Tree & Ornamental 75% WSP) is applied at 12 ounces of active ingredient per 100 gallons of water. Plants are sprayed to drip in the spring and fall. 100% of plants treated. Yield losses of 25 to 50% could result if not treated.

Chlorpyrifos (Dursban 50WP) is applied at 8 ounces of active ingredient per 100 gallons of water. Plants are sprayed to drip in June and August, and 97% of plants are treated. Yield losses of 25-50% could result if not treated.

Bendiocarb (Turcam 76%) is applied at 6.08 ounces of active ingredient per 100 gallons of water. Plants are sprayed to drip during June through November, and 97% of plants are treated. Yield losses of 25-50% could result if not treated.

Sodium aluminofluoride (Gowan Cryolite Bait 20%) is applied at 0.1 to 0.3 pound of active ingredient per 1000 square feet. 0.37% of all plants treated in the spring and the fall. Yield losses of 25 to 50% could result if not treated.

Additional Information

Weevils, aphids, and whiteflies are all controlled using the three products listed above. As growers do not treat for individual insects it is not possible to estimate the losses attributable to just one insect/chemical combination, therefore loss estimates are indicative of damage from all insects should a specific chemistry not be applied.

Aphids *Masonaphis spp.*

These soft-bodied insects are frequently found grouped on stems or lower leaf surfaces, especially on young plant tissue. Aphid feeding causes leaves to curl and flower buds to harden, distorting flowers. Aphid colonies are usually comprised solely of females, which are able to reproduce without mating and without laying eggs. Each female can give birth to a total of 50 to 100 nymphs. The nymphs mature and begin reproducing in 6-8 days. As a result, aphid populations can increase very rapidly, leading to many generations each year. Aphid numbers are generally highest in the early spring and throughout the summer, but aphids can be a problem throughout the year (2,5).

Controls

Cultural

Cultural methods are generally not economically feasible in large-scale commercial production. Aphids may be effectively removed with a strong spray of water in a small growing situation or with a localized infestation.

Biological

Aphids have natural enemies, including green lacewings and predatory mites.

These predators can be used as one tool in an integrated pest management program. Other management strategies are necessary, however, to complement biological agents.

Chemical

Acephate (Orthene Turf, Tree & Ornamental 75% WSP) is applied at 12 ounces of active ingredient per 100 gallons of water. Plants are sprayed to drip in the spring and fall, and 97% of plants are treated. Yield losses of 25 to 50% could result if not treated.

Chlorpyrifos (Dursban 50WP) is applied at 8 ounces of active ingredient per 100 gallons of water. Plants are sprayed to drip in June and August, and 97% of plants are treated. Yield losses of 25-50% could result if not treated.

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Rhododendron Whitefly

Whiteflies are small white insects that hold their wings rooflike over their abdomens rather than flat like true flies. Infested leaves, usually the tender young leaves at the branch tips, are mottled yellow on the upper surface, and the margins often curl. Rhododendrons with smooth surfaces underneath the leaf are most affected. Whiteflies can produce large amounts of sticky honeydew, which can develop a heavy coating of black sooty mold. Whitefly bodies produce visible white residue on leaves. The rhododendron whitefly is mainly an aesthetic pest, although heavy infestations can damage susceptible plants.



White residue on leaves indicates whitefly presence

Controls

Cultural

Whitefly numbers increase with increasing foliar nitrogen levels. Slow-release fertilizers or fertilizers with a lower nitrogen content are used for whitefly management.

Chemical

Acephate (Orthene Turf, Tree & Ornamental 75% WSP) is applied at 12 ounces of active ingredient per 100 gallons of water. Plants are sprayed to drip in the spring and fall, and 97% of plants are treated. Yield losses of 25 to 50% could result if not treated.

Chlorpyrifos (Dursban 50WP) is applied at 8 ounces of active ingredient per 100 gallons of water. Plants are sprayed to drip in June and August, and 97% of plants are treated. Yield losses of 25-50% could result if not treated.

Bendiocarb (Turcam 76%) is applied at 6.08 ounces of active ingredient per 100 gallons of water. Plants are sprayed to drip during June through November, and 97% of plants are treated. Yield losses of 25-50% could result if not treated.

Pyridaben (Sanmite) is applied at 3 ounces of active ingredient per 100 gallons of water. Sprayed to drip from June through September, and 97% of plants are treated. Yield losses of 25-50% could occur if not treated.

Additional Information

Weevils, aphids, and whiteflies are all controlled using the three products listed above. As growers do not treat for individual insects it is not possible to estimate the losses attributable to just one insect/chemical combination, therefore loss estimates are indicative of damage from all insects should a specific chemistry not be applied.

Mites

Twospotted spider mite, *Tetranychus urticae*

Spider mites are among the most common pests of ornamental nursery plants. Twospotted spider mite (*Tetranychus urticae*) can be a serious problem in greenhouses. Found on the lower leaf surface, mites puncture the plant tissue with their piercing mouth parts and suck the plant juices. Severe infestations cause leaves to drop. The leaves and even the entire plant can become covered by the silken webbing spun by this pest. The life cycle of mites under ideal conditions (~ 80°F or 27°C) requires between 7 and 10 days from egg to adult, but can vary even more at other temperatures. Many overlapping generations of mites occur each year, and adult females can lay several hundred eggs during their lifetime. Damage from spider mites tends to be more severe during hot, dry weather. Mites are of little importance in landscape plantings but can be of tremendous importance in nursery and greenhouse settings (2,5).

Controls

Cultural

Cultural methods are generally not economically feasible in large-scale commercial production. Mites may be removed from plants with a strong stream of water when a small mite infestation is developing. An emphasis is placed on maintaining proper plant health to minimize the chance of mite infestation.

Biological

Many species of predaceous mites and insects attack spider mites. These include ladybird beetles, lacewing larvae, true bugs, and various thrips. These predators may be used to complement an integrated pest management program but will not effectively control pests alone in a commercial setting.

Chemical

Bifenazate (Floramite) is applied at 1 to 2 ounces of active ingredient per 100 gallons of water as a full coverage spray from June through September, and 97% of plants are treated. Yield losses of 10-15 % could occur if not treated.

Hexythiazox (Hexygon) is applied at 0.5 to 1 ounce of active ingredient per 100 gallons of water as a full coverage spray including the undersides of leaves, and 97% of plants are treated. Yield losses of 10-15 % could occur if not treated.

Pyridaben (Sanmite) is applied at 3 ounces of active ingredient per 100 gallons of water. Sprayed to drip from June through September, and 97% of plants are treated. Yield losses of 10-15 % could occur if not treated.

Spinosyn A and Spinosyn D (Conserve SC) is applied at 2.3 ounces of active ingredient per 100 gallons of water as a spray to both upper and lower leaf surfaces, and 97% of plants are treated. Yield losses of 10-15 % could occur if not treated.

Dicofol (Kelthane 50% T/O) is applied at 8 ounces of active ingredient per 100 gallons of water. Sprayed to drip from June through September, and 97% of plants are treated. Yield losses of 10-15 % could occur if not treated.

Cutworms, loopers, and sawflies were either not mentioned or mentioned by only one of the respondents. They can be sporadically very significant pests. Chemicals applied for weevil control will control these pests as well.

Diseases

Phytophthora Root Rot

Phytophthora cinnamomi, *P. cactorum*, *P. citricola*

Once this pathogen is established in the soil, it can remain indefinitely. It rots the root system and then continues to the crown and stem. The affected areas can be identified by reddish-brown lesions. Initially, the leaves wilt and eventually the entire plant is killed while the leaves remain attached to the plant.

Controls

Cultural

A listing of hybrid rhododendron varieties and rhododendron species resistant to *Phytophthora* is available through Washington State University (2). Most notable is the species *R. davidsonianum* which also shows resistance to feeding by adult root weevil. Growers use disease-free cuttings, disinfect all propagating tools, and use practical sanitation methods such as good drainage for plants in beds, fields

or containers to help limit development of the disease.

Chemical

Mefenomax (Subdue MAXX at 21.3%) is applied at 0.43 ounces of active ingredient per 100 gallons of water as a soil surface spray. All plants are treated. Yield losses up to 25% could result if not treated.

Fosetyl-Al (Chipco Aliette WDG brand) is applied at 8 to 16 ounces of active ingredient per 100 gallons of water as a foliar spray. All plants are treated. Yield losses from 10% to 15% could result if not treated.

Other Root Rots

Pythium spp., Rhizoctonia solani, Fusarium spp.

Many soilborne fungi can cause rhododendron root rots. They cause wilting, loss of vigor, and severe leaf drop. Roots and crowns of infected plants become black and rotten (3).

Controls

Cultural

Growers often use sterilized or pasteurized soil to help reduce the potential for disease development. Good drainage is a standard practice. Growers also avoid excessive irrigation and nitrogen; this promotes good plant health and decreases plant vulnerability to attack by disease organisms.

Chemical

Fludioxonil (Medallion at 50%) is applied at 4 ounces of active ingredient per 100 gallons of water as a soil drench, and 97% of the plants are treated annually. Yield losses from 25-50% could result if not treated.

Mefenomax (Subdue MAXX at 21.3%) is applied at 0.43 ounces of active ingredient per 100 gallons of water as a soil surface spray. All plants are treated. Yield losses up to 25% could result if not treated.

Powdery Mildew

Microsphaera spp.

This fungus is found throughout the Pacific Northwest on garden azalea and rhododendron species and hybrids. Symptoms of this fungal disease vary depending on the cultivar that is infected. Yellowish-green or purplish-brown spots and blotches occur on the upper leaf surface. Lower leaf surfaces may

have brownish, purplish, or other discolored areas of various shapes and sizes. Leaves may be stunted and sometimes may not show discoloration on the upper leaf surface but may have variously colored areas or powdery growth on the underside. Most azaleas and some rhododendrons may have powdery white growth on both sides of the leaves. Diseased leaves often drop from the plant and the disease can be indirectly fatal by predisposing the plant to winter damage and other stresses (1,2,4).



Powdery Mildew discoloration on leaves

Controls

Cultural

A listing of hybrid rhododendron varieties and rhododendron species resistant to powdery mildew is available through Washington State University Extension (1). Most notable is the species *R. yakushimanum*, which also shows resistance to feeding by adult weevils. For the most part, growers have stopped producing susceptible species. To manage the disease on susceptible plants, growers remove infected plant parts, rake and destroy fallen leaves, and reduce relative humidity by both proper plant spacing and avoiding overhead irrigation. These tactics remove the inoculum and create conditions that discourage the development of this pathogen.

Chemical

Iprodione (Chipco 26019 at 50%) is applied at 1 pound of active ingredient per 100 gallons of water. Plants are sprayed to drip and 97% of plants are treated annually. Yield losses up to 10% could result if not treated.

Captan (Captan 50WP) is applied at 2 pounds of active ingredient per 100 gallons of water. Plants are sprayed to drip, and 97% of plants are treated from August through March. Yield losses up to 10% could result if not treated.

Copper Hydroxide (Kocide 2000 T/N/O at 53.8%) is applied at 0.4 pounds of active ingredient per 100 gallons of water. Plants are sprayed to drip. Multiple applications may be made to current-year leaves when symptoms are first noticed. Three percent of plants are treated annually. Yield losses of up to 50% of the plants usually treated could result if not treated.

Phytophthora blight *Phytophthora syringae*

This fungus causes leaf edges or tips to become necrotic with irregular leaf spots. The infected leaves usually drop. Low temperatures and wounds favor disease development. Rain-splashed or wind-blown inoculum begins the infection. Oospores form in infected leaves and survive until the next rainy season. Cankers on branches are shiny black and branch tips usually die back and the branch defoliates. Other *Phytophthora* spp. can cause leaf spots and dieback but are active in warm summer weather (4).

Controls

Cultural

Growers prune off infected leaves and branches and rake up and destroy dead leaves around the base of plants to reduce disease inoculum.

Chemical

Fosetyl-Al (Chipco Aliette WDG brand) is applied at 8 to 16 ounces of active ingredient per 100 gallons of water as a foliar spray. All plants are treated. Yield losses from 10% to 15% could result if not treated.

Botrytis Shoot and Petal Blight *Botrytis cinerea*

Blight is identified by brown, water-soaked lesions occurring in the middle of the shoot on the leaves or petals during early spring. A mass of gray spores may be produced on the leaf surface. Infected shoots bend over at the lesion and may remain crooked or die back. Purple varieties are more susceptible to this disease (4). True resistance is not available as *Botrytis* is an opportunistic pathogen.

Controls

Cultural

To help reduce disease incidence, growers adjust plant spacing to reduce humidity and increase air circulation.

Chemical

Fenhexamid (Decree 50WDG) is applied at 0.5 to 0.75 pounds of active ingredient per acre. The product is mixed with water and applied to cover all plant surfaces, with 97% of plants treated annually. Yield losses up to 10% could result if not treated.

Copper Salts of fatty and rosin acids (Camelot) is applied at 28 ounces of active ingredient per 100 gallons of water. Foliage and stems are sprayed to runoff and 97% of plants are treated annually. Yield losses up to 10% could result if not treated.

Iprodione (Chipco 26019 at 50%) is applied at 1 pound of active ingredient per 100 gallons of water. Plants are sprayed to drip and 97% of plants are treated annually. Yield losses up to 10% could result if not treated.

Captan (Captan 50WP) is applied at 2 pounds of active ingredient per 100 gallons of water. Plants are sprayed to drip and 97% of plants are treated from August through March. Yield losses up to 10% could result if not treated.

Copper Hydroxide (Kocide 2000 T/N/O at 53.8%) is applied at 0.4 pounds of active ingredient per 100 gallons of water. Plants are sprayed to drip once in the spring when symptoms are first noticed. Three percent of plants are treated annually. Yield losses of up to 50% of plants usually treated could result if not treated.

Weeds

Both mechanical and chemical weed control methods are used for rhododendron and azalea production. Some common weed species include chickweed (*Stellaria media*), common lambsquarters (*Chenopodium album*), shepherd's-purse (*Capsella bursa-pastoris*), common groundsel (*Senecio vulgaris*), smooth hawkbeard (*Crepis capillaris*), annual sowthistle (*Sonchus oleracea*), smartweeds (*Polygonum* spp.), oxalis or woodsorrel (*Oxalis* spp.), white clover (*Trifolium repens*), annual bluegrass (*Poa annua*), common dandelion (*Taraxacum officinale*), common catsear (*Hypochaeris radicata*), Canada thistle (*Cirsium arvense*), shotweed (*Cardamine*

oligostermum), and horsetail (*Equisetum* spp.)

Site Preparation

Mechanical

Liner bed areas are cultivated to prepare the soil and eliminate germinated weed seedlings. Fabric weed barriers are also widely used, and are placed under containers to help reduce emergence of annual and certain perennial weeds during production.

Chemical

Napropamide 4%, Oxadiazon 2% (Pre Pair) is applied at 9 pounds of active ingredient per acre in late fall to early spring, prior to weed emergence. This herbicide combination provides good control of a variety of germinating weed seeds, including both broadleaf and grass species, but is relatively weak on smartweeds and legumes. Neither napropamide nor oxadiazon effectively controls emerged weeds or established biennial/perennial species, however. Seventy-eight percent of the crop is treated annually. Yield losses up to 30% could result if not treated.

Trifluralin 2%, Isoxaben 0.5% (Snapshot 2.5 TG) is applied at 3.75 pounds of active ingredient per acre in late fall to early spring, prior to weed emergence. This herbicide combination provides good control of a variety of germinating weed seeds, including both broadleaf and grass species, but is relatively weak on mustard family weeds. Neither trifluralin nor isoxaben effectively controls emerged weeds or established biennial/perennial species. Twenty-four percent of plants are treated annually. Yield losses up to 30% could result if not treated.

Glyphosate (Roundup Ultra at 41%) is applied at 13 to 26 ounces of active ingredient per acre. Glyphosate controls most emerged weed species, and is especially useful for control of established biennial and perennial weeds. Two percent of the total crop is treated annually before planting. Yield losses up to 80% could result among the plants usually treated if left uncontrolled. Because glyphosate does not have soil activity, however, weed seedlings that emerge after glyphosate application are not controlled.

Post-planting

Cultural

Handweeding in containers and adjacent to liners as needed.

Chemical

Glyphosate (Roundup Ultra at 41%) is applied as a directed spray at 13 to 26 ounces of active ingredient per acre. Glyphosate is a contact herbicide and is not sprayed over the top of plants. It is actively absorbed by leaves of most plants and translocated to the roots to give excellent control of most weed species, including annuals, biennials, and established perennials. Glyphosate is the only herbicide currently registered for application in nurseries that is effective in controlling

emerged weeds. This herbicide, however, has no soil activity to control seeds that may germinate following application. To adequately control emerging weeds, glyphosate or a tank mixture with other herbicide products (as listed below) must be reapplied to each weed flush. One percent of the plants are treated with glyphosate, usually once in the fall and again in the spring. Yield losses up to 80% could result if not treated.

Isoxaben (Gallery 75DF) is applied at 12 ounces of active ingredient per acre during mid-summer. Isoxaben must be applied preemergence to the weeds, as only germinating weed seedlings are controlled by this product. Isoxaben controls a wide variety of broadleaf weed species, but does not adequately control grasses or established perennials. 97% of the plants are treated annually. Yield losses up to 30% could result among the plants usually treated if left uncontrolled.

Napropamide (Devrinol 50DF) is applied at 4 pounds of active ingredient per acre during mid-summer. Napropamide must be applied preemergence to the weeds, as only germinating weed seedlings are controlled by this product. Napropamide controls many weed species, including both broadleaf and grassy weeds, but does not adequately control established perennials. Ninety-seven percent of the plants are treated annually. Yield losses up to 30% could result if not treated.

Oryzalin (Surflan A.S. at 40.4%) is applied at 25.9 ounces of active ingredient per acre. Oryzalin must be applied preemergence to the weeds, as only germinating weed seedlings are controlled by this product. Oryzalin controls many weed species, including both broadleaf and grassy weeds, but does not adequately control established perennials. Twenty percent of the plants are treated annually. Yield losses up to 30% could result among the plants usually treated if left uncontrolled.

ADDITIONAL NEEDS

The nursery industry has identified liverworts as a serious pest for which there are, at present, no effective controls. This weed easily infests containerized plants, competes for nutrients, and decreases salability of ornamentals. At present, this is the most critical unmet pest control need.

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ADDITIONAL RESOURCES

American Rhododendron Society

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Phone (707) 725-3043

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<http://www.rhododendron.org>

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