Control of Common Barberry to Reduce Stem Rust of Wheat and Barley

WASHINGTON STATE UNIVERSITY EXTENSION FACT SHEET • FS151E

The Connection Between Cereal Stem Rust and Common Barberry

The common barberry (*Berberis vulgaris*) is a woody shrub that is the alternate host for the stem rust pathogen of wheat and barley. The stem rust fungus (*Puccinia graminis*) can cause total yield loss in wheat or barley crops in years that have persistent, late-season rainfall or warm, humid nights. For more information on stem rust of wheat and barley, view *Identifying Rust Diseases of Wheat and Barley*, Washington State University Extension Publication MISC0197E (De Wolf et al. 2010) at https://pubs.wsu.edu/ListItems.aspx?Keyword=197e and *Identification and Management of Stem Rust on Wheat and Barley* (De Wolf et al. 2011) at http://smallgrains.wsu.edu/wp-content/uploads/2013/10/Stem-Rust-Man-WA.pdf.

Common barberry, the alternate host for the stem rust fungus, is essential for the spread of the pathogen.

The stem rust fungus has three life stages (Figure 1):

- Stage 1—The rust fungus survives over the winter on infected wheat or barley stubble.
- Stage 2—In the spring, the rust fungus moves to common barberry shrubs—its alternate host—where it produces new races or biotypes (via sexual reproduction).
- Stage 3—During late spring and summer, the rust fungus moves to susceptible wheat or barley plants, where it reproduces asexually every 10 to 14 days. If there is adequate late-season moisture during this stage, the fungus may be blown by the wind and spread over great distances.

During the twentieth century, the United States federal government conducted an eradication program for the common barberry that focused on breaking the life cycle of the stem rust fungus by destroying its alternate host. When the federal eradication program ended in the early 1980s, stem rust was not a significant problem. However in 1999, the stem rust race/biotype UG99 was discovered in Africa. This race was able to overcome the resistance of over 80% of the world's wheat varieties. The discovery of this race and the presence of diverse stem rust strains in wheat-producing

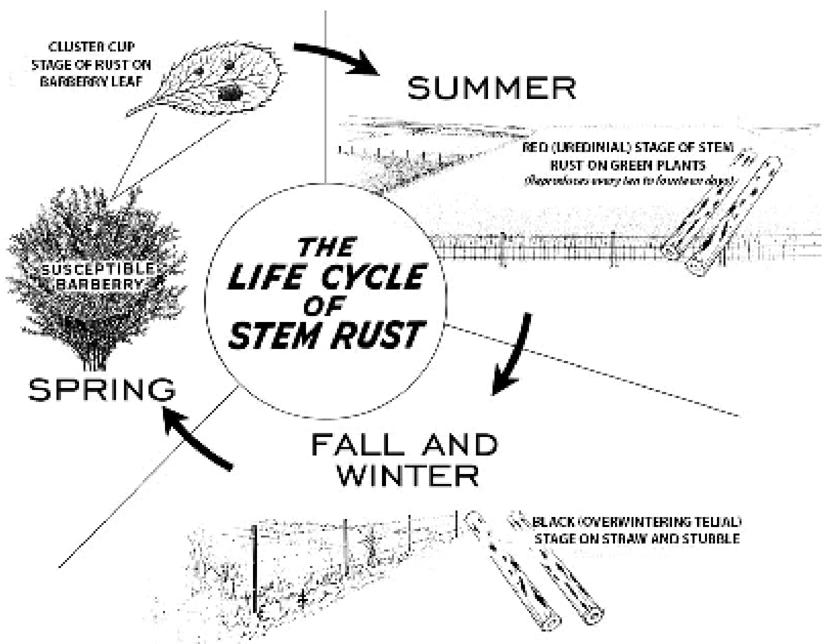

Figure 1. The stem rust fungus depends on common barberry to complete its lifecycle. (Illustration courtesy of USDA-ARS)

regions have rekindled the need for effective control of regrowing barberry shrubs. Stem rust will likely be a problem in Washington State for the long-term due to the amount of common barberry located throughout the state and throughout the northwest. Stem rust infections in eastern Washington have been reported with greater frequency since 2007—corresponding with an increasing number of barberry bushes and favorable weather conditions.

The common barberry shrub is listed as a Class C Noxious Weed in Washington State.

Landowners in Washington State should contact their local County Noxious Weed Control Board to determine whether control of common barberry is required.

Although stem rust is seldom a widespread problem in cereal crops in the Inland Northwest, it has great potential for damage in the upper Midwest and Northern Plains. The presence of common barberry bushes, where the rust fungus reproduces sexually, raises concern that the Pacific Northwest could become a “nursery” for new rust races. There is evidence that new races of the stem rust fungus are able to blow across the Rocky Mountains into the northern cereal-producing states, where they could cause widespread crop loss.

Identification of Common Barberry

The common barberry shrub, a native of Europe, was introduced to North America by settlers who used the berries and the hard, woody stems. Consequently, the plants are often found around old homesteads.

Common barberry shrubs may grow 8 to 10 feet tall (Figure 2) and are the easiest to spot in the spring when their flowers are present (Figure 3) and in the fall because they retain their leaves longer than most shrubs (Figure 4).

The bushes bear clusters of yellow flowers in May and June (Figure 3), which develop into oblong berries approximately ¾ of an inch long (Figure 5) that turn bright red in the fall (Figure 6).

When the bark is cut away, the common barberry bush shows a bright yellow wood (Figure 7).

Other defining features of common barberry are the leaves, which have spiny edges and three or more spines at the base (Figure 8).

The Japanese barberry, common in landscaping, has smooth-edged leaves with usually one spine at the leaf base (Figures 9 and 10). Barberry bushes that are purchased from nurseries today are Japanese barberry types (*Berberis thunbergii*). The Washington State Department of Agriculture inspects the Japanese barberry nursery stock to make sure it is resistant to stem rust.

Figure 2. Large barberry bush in June. (Photo by Diana Roberts, WSU Extension.)

Figure 3. Common barberry flowers (May–June). (Photo by Tim Murray, WSU Extension.)

Figure 4. Large barberry bush showing fall leaf coloration. (Photo by Diana Roberts, WSU Extension.)

Figure 5. Green berries of the common barberry (in June) infected with stem rust. (Photo by Diana Roberts, WSU Extension.)

Figure 8. Barberry leaves are spiny-edged and have three spines at the base. (Photo by Stephen Van Vleet, WSU Extension)

Figure 6. Barberry in the fall showing clusters of red berries. (Photo by Diana Roberts, WSU Extension.)

Figure 9. Japanese barberry showing smooth leaf edges and a single spine. (Photo by Stephen Van Vleet, WSU Extension)

Figure 7. A barberry stem showing bright yellow wood and three spines at leaf bases. (Photo by Diana Roberts, WSU Extension.)

Figure 10. Natural growth shape of Japanese barberry, which are often trimmed into round bushes in landscaping. (Photo by Stephen Van Vleet, WSU Extension)

Control of Common Barberry

History of management methods for common barberry

Stem rust has caused grain yield reductions in the United States since the eighteenth century; however, control of common barberry, the alternate host, was not a major focus until the twentieth century. In 1918, the federal government began an eradication program for common barberry in order to break the life cycle of the stem rust pathogen. This program began to phase out in 1980 (Peterson et al. 2005).

Control measures for common barberry evolved significantly during the course of the eradication program. Prior to the 1920s, control methods included digging and pulling out the shrubs. After the 1920s, crushed rock salt, kerosene, and sodium arsenate were used. However, kerosene was very slow in providing control and sodium arsenate was found to attract livestock, so it was discontinued (Kempton and Thompson 1925; Thompson 1924). Table salt (sodium chloride) began to be used for barberry control in the mid-1930s. Shrubs were either pulled out or a trench was dug around their bases and then each was treated with 20 to 100 pounds of salt. This constituted the preferred treatment for common barberry in the next two and a half decades. However, it was difficult to transport the large amounts of salt needed to adequately control common barberry infestations in remote locations, so an alternative treatment program was sought.

A new barberry control strategy emerged in the early 1950s that made use of a new application technique: the cut-stump technique. The barberry shrub was cut off at the base and then treated with a small amount of ammonium sulfamate. This type of herbicide application became the treatment of choice for small populations of common barberry during the remainder of the federal eradication program. At this same time, larger barberry infestations were successfully treated with a 2 to 1 combination of 2,4-D + 2,4,5-T applied to foliage (USDA-ARS Plant Pest Control Division 1972). The discussion of chemical use is given here for historical perspective only. Currently, these chemical uses are not registered and would be illegal.

Current control methods for common barberry

In 2011, a demonstration study was conducted to determine the best way to control common barberry. Nine large barberry shrubs were identified in a sub-irrigated flat near Viola, ID, close to the border of Whitman County, WA. Then 7 of the 9 identified shrubs were cut using a chainsaw and 6 of those were treated with selected herbicides applied to the stump (cut-stump technique for woody shrubs).

One entire uncut shrub located in an open area away from other shrubs and trees was treated with the foliar herbicidal spray imazapyr (Figure 11). The imazapyr was applied as a 2% solution (by volume) in water; a nonionic surfactant at 0.25% was also added prior to application. The herbicide was applied to all barberry foliage using a backpack sprayer. Imazapyr was selected for this foliar application because

Figure 11. Barberry shrub after foliar herbicide application. (Photo by Stephen Van Vleet, WSU Extension)

it tends not to move into the soil after plants are treated, thereby reducing off-target leaching and the chance of injury to non-target plants.

Another uncut barberry shrub was set apart (but adjacent to other trees and shrubs) and left untreated, so it could be compared to treated shrubs to determine the amount of fungal infection developing throughout the year (Figure 12).

Figure 12. Untreated barberry (used for comparison with treated shrubs) located near other trees and shrubs. (Photo by Stephen Van Vleet, WSU Extension)

Herbicide-treated common barberry plants in this study showed no regrowth during the two years following treatment.

The seventh shrub that was cut down (no herbicide applied) was evaluated for vegetative regrowth one year later and significant regrowth occurred over the following year (Figure 13).

Figure 13. Barberry regrowth one year after cutting (no herbicide applied). (Photos by Stephen Van Vleet, WSU Extension)

The six shrubs to receive cut-stump treatments were cut approximately 3 inches above the ground, and the cut surface of each stem was immediately treated with imazapyr, picloram, or a mixture of triclopyr + 2,4-D. Herbicides were mixed with crop oil concentrate (without water) at a rate of 100% (by volume), then applied to the stump using a paintbrush (Figure 14). Each stem was treated within a few minutes of cutting because herbicides become less effective if applied after the cut surface has dried.

The tested herbicide treatments provided 100% control of common barberry. Ongoing evaluation of treated shrubs continued for two years. There was no regrowth of any barberry shrub treated with foliar or cut-stump herbicides applied at these rates during that two-year period (Figure 15). Because this was a demonstration study only, these results must be considered preliminary. Still, they offer evidence that these herbicides have the ability to provide effective control of the common barberry bush.

Even though common barberry is not mandated for control in many states or counties, landowners should do their part to control this shrub to prevent the development of new races of stem rust.

Figure 14. Barberry cut-stump treatments (A) paintbrush application to a stump; (B) stump cluster immediately after herbicide application. (Photos by Diana Roberts, WSU Extension)

Figure 15. Absence of regrowth one year after cut-stump herbicide application. (Photo by Stephen Van Vleet, WSU Extension)

References

De Wolf, E., T. Murray, P. Pierce, L. Osborne, and A. Tenuta. 2010. Identifying Rust Diseases of Wheat and Barley. *Washington State University Publication* MISC0197E. https://pubs.wsu.edu/ListItems.aspx?Keyword=197e.

De Wolf, E., T. Murray, P. Pierce, L. Osborne, and A. Tenuta. 2011. Identification and Management of Stem Rust on Wheat and Barley. http://smallgrains.wsu.edu/wp-content/uploads/2013/10/Stem-Rust-Man-WA.pdf.

Kempton, F.F., and N.F. Thompson. 1925. The Common Barberry and How to Kill It. USDA Department Circular 356. Washington, D.C.: GPO.

Peterson, P.D., K.J. Leonard, J.D. Miller, R.J. Laudon, and T.B. Sutton. 2005. Prevalence and Distribution of Common Barberry, the Alternate Host of *Puccinia graminis*, in Minnesota. *Plant Disease* 89: 159–163. http://apsjournals.apsnet.org/doi/pdf/10.1094/PD-89-0159.

Thompson, N.F. 1924. Chemical Eradication of the Common Barberry. USDA Department Circular 332. Washington, D.C.: GPO.

USDA–ARS. Plant Pest Control Division. 1972. Barberry Eradication Control Manual: 807-01.2100, 2200, 2300. Washington, D.C.: GPO.

Washington State University Extension

By **Stephen Van Vleet**, Regional Extension Specialist, Agriculture and Natural Resources; and **Diana Roberts**, Regional Extension Specialist, Agronomy.

Use pesticides with care. Apply them only to plants, animals, or sites as listed on the label. When mixing and applying pesticides, follow all label precautions to protect yourself and others around you. It is a violation of the law to disregard label directions. If pesticides are spilled on skin or clothing, remove clothing and wash skin thoroughly. Store pesticides in their original containers and keep them out of the reach of children, pets, and livestock.

WSU Extension bulletins contain material written and produced for public distribution. Alternate formats of our educational materials are available upon request for persons with disabilities. Please contact Washington State University Extension for more information.

You may download copies of this and other publications from WSU Extension at http://pubs.wsu.edu.

Issued by Washington State University Extension and the U.S. Department of Agriculture in furtherance of the Acts of May 8 and June 30, 1914. Extension programs and policies are consistent with federal and state laws and regulations on nondiscrimination regarding race, sex, religion, age, color, creed, and national or ethnic origin; physical, mental, or sensory disability; marital status or sexual orientation; and status as a Vietnam-era or disabled veteran. Evidence of noncompliance may be reported through your local WSU Extension office. Trade names have been used to simplify information; no endorsement is intended. Published November 2014.

FS151E