

branch. Each year the plant loses more vigor and is progressively more dwarfed. Fruiting laterals are shorter and more upright than normal ones. Berries on infected plants may ripen prematurely and are small, dry, seedy, and crumbly.

The raspberry leaf curl virus, the causal agent of raspberry leaf curl disease, is spread exclusively by the small raspberry aphid (*Aphis rubicola*). Heavy populations of this aphid can cause severe inrolling of leaves even in the absence of the leaf curl virus. Winged forms of the aphid can transmit the virus to healthy raspberries from nearby infected brambles. Windborne aphids may spread the disease several miles.

Raspberry Streak

Raspberry streak, caused by tobacco streak virus, is generally a minor but widespread disease. It is presently limited to northern Ohio, western Pennsylvania, and western New York. Streak affects only black raspberries.

The most obvious symptom of the disease is numerous purplish streaks that appear on the lower parts of infected canes. Usually, the streaks are less than an inch long. Terminal leaves on infected canes are often hooked or recurved, twisted or rolled, and darker green than normal. Leaves on the lower positions of the cane may show yellowing along veins and mottling. Fruits on infected canes are smaller than normal, dull, seedy, and crumbly and lack flavor. The individual drupelets often ripen unevenly, giving the fruit a blotched appearance.

Tomato Ringspot Virus

This virus disease occurs only in red raspberries and is widespread in the major red raspberry-producing areas of the Pacific Coast and northeastern United States. Infected plants may appear normal, but they are usually somewhat less vigorous than healthy plants. The most obvious symptom of the disease is the production of small, crumbly berries that fall apart when touched. The crumbly berry is caused by the failure of some of the tiny fruitlets (drupelets), which make up the fruit, to develop.

The tomato ringspot virus can affect many other species of woody and herbaceous plants. This virus is transmitted through the soil by the dagger nematode (*Xiphinema americanum*).

Control of Virus Diseases

Always start new plantings with the highest-quality plants available. Use only certified, disease-free, virus-indexed stock. Avoid obtaining uninspected plants from friends or neighbors. Select a planting site that is sunny and fertile and has good air and water drainage. Destroy all wild and neglected raspberries and other brambles located within 500 to 1,000 feet of your planting site.

Do not plant black or purple raspberries near red raspberries, even though the red raspberries appear to be healthy. Red raspberries may have latent infections. This means that they can be infected but do not show symptoms. Even though infected plants are symptomless, the virus can still be transmitted from them to healthy plants.

If black and red raspberries are planted together, separate them as far apart as possible. If possible, plant black raspberries upwind from reds. The reason for this is the aphids that transmit viruses are generally blown or carried by wind rather than by active flight. Therefore, you do not want aphids to be blown from your red raspberries to your more susceptible black raspberries.

Go through the raspberry planting at least twice a year and remove all plants showing any virus symptoms. This should be done once about mid-June and again in August or September. Before removing infected plants, kill all aphids on them by spraying infected plants with an insecticide a day or two before removal. Dig out the diseased plants, including roots, and dispose of them away from the planting site.

In established plantings, where more than 5% to 10% of the plants show visible virus symptoms, removal of infected plants probably will not pay. In this case, maintain the planting until fruit yield becomes unprofitable, then destroy it. It is unwise to establish new plantings next to old, infected ones. Maintain strict aphid control at all times, especially in late spring and early summer when aphid populations are highest.

If the virus is transmitted by nematodes, the nematodes must be controlled in order to control the disease. Have the soil tested for plant parasitic nematodes before planting. Samples should be taken in July of the year preceding planting. Spring



samples, taken when soils are cold, are not accurate and do not give the grower sufficient time to apply a preplant nematicide. Information on collecting soil samples and submitting them for analysis is available from your Extension service.

Use of Disease-Resistant Cultivars

In an organic disease-management program where emphasis is placed on reducing overall fungicide use, it is essential to identify any available disease resistance and use it. Unfortunately, a high level of resistance to most of the major diseases is not available in most commercially grown raspberry and blackberry cultivars in the Midwest. Thus, the disease-management program must rely mainly on the use of cultural practices and efficient fungicide use. Whereas resistant cultivars are not generally available for most diseases, cultivars do vary greatly in their level of susceptibility to certain diseases. If resistance is not available, those cultivars that are highly susceptible to important diseases at least should be avoided.

Notes on Disease Resistance

Phytophthora Root Rot

Phytophthora root rot is most serious on red raspberries and some of the hybrids. The black raspberry cultivars Cumberland and Munger are reported to be susceptible. The cultivars Bristol, Dundee, and Jewel appear to be moderately to highly resistant. Among red raspberry cultivars, none are immune to the disease, but cultivars do differ greatly in their level of susceptibility. Among cultivars grown in the Midwest and Northeast, Titan and Hilton are extremely susceptible, with Festival, Heritage, Reveille, and Taylor moderately to highly susceptible. Newburgh is somewhat resistant, and Latham, Boyne, Killarney, and Nordic are considered to be fairly resistant.

Verticillium Wilt

Red raspberries are more tolerant than black raspberries. Cuthbert and Syracuse appear to be resistant under field conditions. Black raspberries are highly susceptible. Blackberries are susceptible, but the disease is seldom a serious problem.

Orange Rust

Red raspberries are immune. Other brambles are susceptible. Of blackberries, Eldorado, Raven, Snyder, and Ebony King are reported to be resistant. The Arkansas erect types (Arkansas Indian series) are reported to be resistant to orange rust.

Virus Diseases

Mosaic Virus

Blackberries are resistant. Black and purple raspberries are more severely affected than red raspberries. Of the purple or black raspberries, New Logan, Bristol, and Black Hawk are tolerant, and Cumberland is susceptible. The red raspberries Milton, September, Canby, and Indian Summer are resistant because the aphid vectors of the virus avoid them.

Leaf Curl Virus

Blackberries are symptomless. All raspberries are susceptible.

Tomato Ringspot Virus

Red raspberries and blackberries are susceptible.

Raspberry Streak

Black and purple raspberries are susceptible.

Cultural Practices for Disease Control in Brambles

The use of any practice that reduces or eliminates pathogen populations or creates an environment within the planting that is less conducive to disease development must be used. It is important to remember that many diseases, such as viruses, cannot be controlled with fungicides. Thus, cultural practices are the major means for their control. When fungicides are used, certain cultural practices, such as maintaining narrow row width or cane thinning to open the plant canopy, will greatly increase the efficacy of the fungicide program by allowing better spray penetration and promoting faster drying of susceptible plant parts. The practices described in the next section should be carefully considered and implemented whenever possible in the disease-management program.

