W 833

Rose Diseases: Identification and Management

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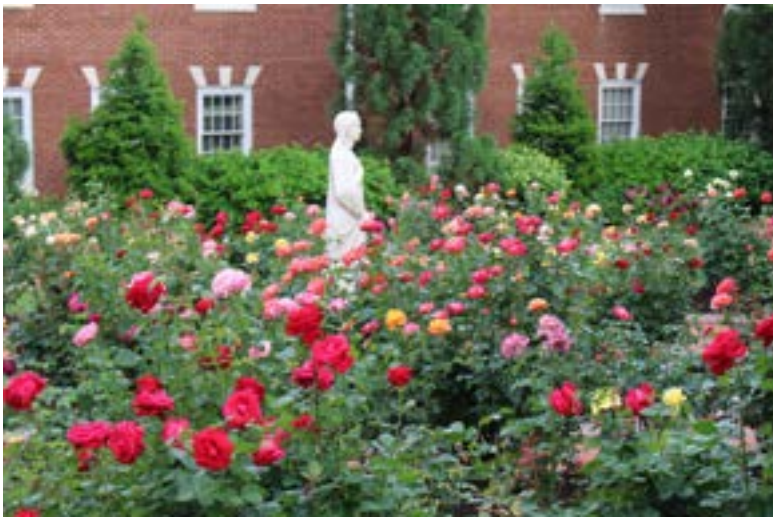
Roses are the most popular ornamental plant grown in gardens throughout Tennessee. No other ornamental plant will reward you with numerous blooms, often for long periods of time. A variety of flower shapes, sizes and fragrances are added bonuses. Plant diseases can detract from a rose's beauty and sometimes cause extensive damage, even death. Identifying rose diseases and choosing best management strategies will help minimize the impact of plant diseases.



Diseases of roses are primarily caused by fungi, bacteria and plant viruses. Fungal pathogens are responsible for diseases such as powdery mildew, downy mildew, anthracnose, canker diseases, rust, root rots, gray mold, ghost spot and leaf spot diseases such as black spot and cercospora leaf spot. Plant viruses cause diseases such as rose mosaic and rose rosette disease. Crown gall is caused by a bacterium. Fungi are responsible for most common rose diseases, but the rose rosette virus is the most economically important rose pathogen at this time.

Powdery Mildew

Powdery mildew is caused by the fungal pathogen *Podosphaera pannosa* (syn *Sphaerotheca pannosa*). Signs of the pathogen include white, powdery fungal growth on leaves, petioles and flower buds (Figure 1). Symptoms of powdery mildew include blistering and twisting of leaves and red-to-burgundy foliage.

Powdery mildew may be severe in periods of warm, humid weather when rainfall is limited. Although high humidity is needed for spore germination, free moisture on leaves is not needed as it inhibits germination of spores. Spores are disseminated in air currents. The fungus overwinters in infected rose canes and leaf litter underneath plants.

Management of powdery mildew includes cultural strategies such as removal of diseased foliage and canes, dormant oil sprays in the winter, resistant cultivars and fungicides. Fungicides are more effective if applied before disease development as a preventative measure rather than as a control measure after it becomes severe in the garden.

Figure 1. Powdery mildew on leaves (top left) and flower buds (top right); powdery mildew sporulation on a rose cane (bottom).

Figure 2. left: Black spot lesions on an infected rose; center: Wet foliage is ideal for infection; right: Spores of the fungus that causes black spot.

Black Spot

Black spot is caused by the fungal pathogen *Diplocarpon rosae.* Symptoms include black-to-brown spots with diffuse (feathery) borders (Figure 2). When conditions are favorable for disease development, plants may lose all of their leaves. Often leaves turn yellow before defoliating. After defoliation, canes may be bare of leaves except at the growing tips. Early in the season, spotting occurs on older leaves near the bottom of plants and progresses up the canes. Susceptible plants may refoliate only to have leaves drop off again after symptoms of black spot appear on the new leaves. The defoliation/refoliation cycle can occur several times during the growing season. Purple-to-black lesions may form on the canes in the fall. Plants with severe symptoms are stunted with smaller and fewer flowers. After several years of severe symptoms, stunted plants may die.

Spores of *D. rosae* require at least six hours of leaf wetness to germinate. Black spot is favored by warm, wet weather. High humidity that prevents foliage from drying quickly in the morning will also favor the disease. The fungus also will produce spores on defoliated foliage lying at the base of the plant. This is why the disease seems to spread from the base of the plant upwards.

Cultural controls for black spot include sanitation (cleaning of defoliated debris in late winter, early spring), proper pruning to ensure good air movement through the canopy, and watering so that the length of time foliage remains wet is reduced. Drip irrigation can also be used to reduce the length of time that foliage is wet.

Resistance for black spot in modern rose cultivars is becoming more common as rose companies have made black spot resistance a breeding priority. However, be cautious when a plant is deemed to be resistant. Researchers from the University of Tennessee Institute of Agriculture tested more than 200 rose cultivars that had been marketed as disease resistant by rose producers. Only about 10 percent of the cultivars displayed acceptable levels of resistance to black spot and cercospora leaf spot in the multiyear study. Since that study's completion more than a decade ago, some of the roses that were rated as resistant have failed in studies in other parts of the country. The most likely reason is the ability of the black spot pathogen to make genetic changes and perhaps differences in environmental conditions. Diverse populations of the black spot pathogen are known to exist in the United States; the list of new strains of *D. rosae* keeps growing.

In parts of the U.S. where black spot severity is high, fungicides may be required to successfully grow many cultivars of roses. These fungicides will be most effective if used preventatively. As the pathogen is known to rapidly change genetically, it is important to rotate fungicides with different modes of action.

Downy Mildew

Downy mildew is caused by the fungal-like organism, *Peronospora sparsa*. Although the pathogen resembles a fungus in its appearance, in the way it spreads, and how it infects a host, *P. sparsa* is not a fungus. The organism is more closely related to diatoms and brown algae. This lack of genetic relationship with fungi is why many fungicides that are used to control foliar fungal diseases such as black spot do not work for downy mildew. Symptoms of downy mildew include angular brown, red or purple lesions that may be limited by veins in the leaf (Figure 3). Defoliation can be sudden, severe and occur before leaf lesions are detected. Foliar symptoms are variable among rose species and cultivars. Although symptoms on the upper leaf surface may be very severe, signs (sporulation) on the lower leaves may be difficult to see without a hand lens or microscope. Look for white-to-gray fungal growth on the underside of lesions during cool, wet weather.

The optimum environment for downy mildew development is cool temperatures (40 F to 74 F) and high humidity (> 85 percent). These conditions often occur in unheated polyhouses at nurseries and garden centers in the spring, shortly after sunset when relative humidity spikes as air temperatures rapidly decline. Spores will germinate rapidly (in four hours) on wet leaves. The pathogen overwinters in infected canes and roots.

Controlling downy mildew may be difficult once an outbreak occurs. Sanitation (removing leaf litter) by removing symptomatic bushes and applying protectant fungicides labelled for downy mildew may be necessary. If roses are in a polyhouse or greenhouse, a good cultural practice for reducing favorable conditions for disease development is to open greenhouses (and use fans if possible) to replace the air in the greenhouse before shutting it down at night. At the end of the day, air outside the greenhouse contains much less water than the air inside, where plants have been transpiring (losing water through their foliage) all day. Symptoms of downy mildew on rose foliage can be found on roses for sale in the spring. Inspect roses before buying; do not buy infected plants.

Figure 3. left: Angular red lesions of downy mildew on rose; center: Sparse sporulation of the causal fungus on the underside of lesions; right: Spores (sporangia) of Peronospora sparsa.

Cercospora Leaf Spot (CLS)

This foliar leaf spot disease is caused by the fungus *Cercospora rosicola*. In some geographic areas, CLS may be as severe as black spot. Symptoms of CLS include purple, maroon or brown, or black lesions on upper surfaces of mature leaves (Figure 4). Spots may enlarge and have brown-to-gray necrotic centers. Some cultivars may defoliate with heavy disease pressure. This disease may be confused with black spot and anthracnose. However, these diseases can be separated easily. Black spot lesions have diffuse (irregular or feathered) borders whereas CLS lesions have more even margins. Anthracnose and CLS can be separated by season. Anthracnose is a cool-season disease (spring), and CLS is a hot-season disease (summer).

Cercospora leaf spot commonly occurs in hot (> 85 F), humid weather. The disease was thought to be only a problem in the Deep South, but the range has expanded northward with warming temperatures. Plants thought to be resistant to black spot may defoliate from CLS in warm seasons with prolonged periods of rainy weather. Cercospora leaf spot may be a problem on shrub roses that are not affected by black spot. Little research has been done on this disease and little is known about how the environment influences the pathogen's disease cycle.

Control of CLS is similar to that for black spot. Fungicides that are effective for black spot are also effective for CLS. Recently, public and private breeders have started to focus on breeding CLS-resistant plants since this disease is becoming more prevalent.

Anthracnose

Anthracnose is a fungal disease caused by *Sphaceloma rosarum*. This disease is common in the northern half of the country and in the Deep South where roses may retain foliage into winter months. Symptoms of anthracnose in northern areas occur in the spring and include leaf spots on upper leaf surfaces with red, maroon or purple borders (Figure 5). Lesion centers often turn brown or gray and may drop out of the lesions. In serious cases, leaf drop may be severe. The disease may move out of the leaf into the petiole and into the cane where it may rapidly form a bright yellow canker. Spores of the pathogen are splash dispersed by overhead irrigation or rain. Well-spaced plants and drip irrigation may slow the spread of this disease. Fungicides approved for black spot and CLS are usually effective against anthracnose.

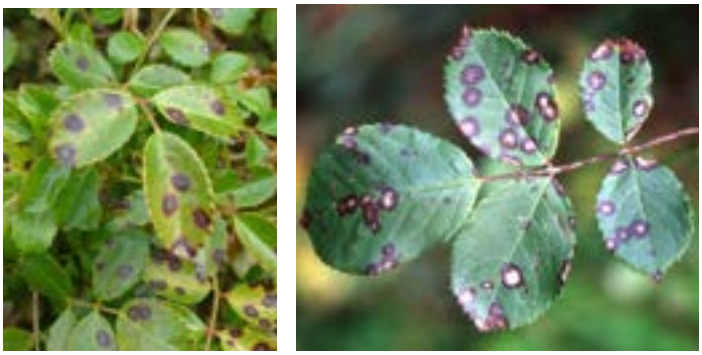


Figure 5. Anthracnose leaf spots on rose.

Figure 4. left and center: Cercospora leaf spot on rose; right: Cercospora spores from a lesion.

Figure 6. Botrytis blight (gray mold) on rose flowers.

Botrytis Blight

Botrytis blight, also called gray mold, is a fungal disease caused by *Botrytis cinerea.* The disease is common on petals of older flowers, flower buds, and leaves (especially when leaves are touching each other) following periods of cool, wet weather. Rose blooms with high petal count are affected by this disease as blooms may hold water between the petals for long periods of time. Signs of the pathogen, gray-to-brown fungal growth, are often visible on blighted petals and leaves early in the morning (Figure 6).

Management of botrytis blight during rainy weather may be difficult. Prune out any blighted foliage or blooms as soon as possible to reduce the number of spores. Remove infected plant material from your garden. Deadhead (pruning of blooms) bushes on a regular schedule to prevent older blooms from serving as a source of the fungus. Companion plants (annual bedding plants or flowering plants) grown with roses are becoming more common. Avoid "self-cleaning" plants, such as geraniums and petunias, as these plants are common hosts of Botrytis. Fungicide resistance is a problem for greenhouse-grown roses but not usually for landscape-grown roses. Rotate fungicides with different modes of action.

Ghost Spotting

Ghost spotting is caused by several fungi including species of *Bipolaris, Botrytis, Cercospora* and *Cladosporium*. Symptoms include small pink-to-white spots with pink borders (Figure 7). Small spots may combine on blighted petals.

Ghost spotting may be severe during prolonged periods of rain. Control is difficult and usually limited to removing infected blooms. Protectant fungicides are of little use due to the environment (rain) conducive to this disease. Systemic fungicides are also ineffective as little fungicide accumulates in the petals.

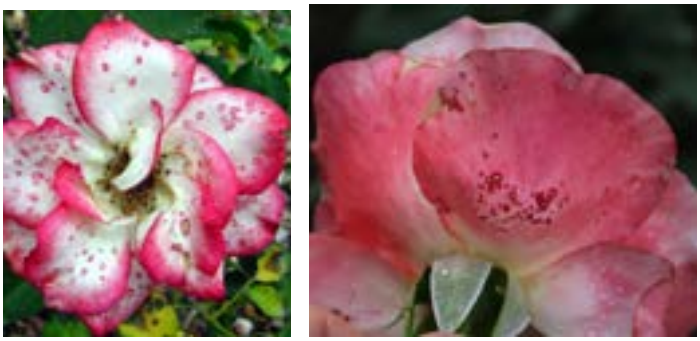


Figure 7. Ghost spotting of rose blooms.

Rust

Rust is caused by the fungi *Phragmidium mucronatum* and *P. tuberculatum.* This disease is a common problem in the western U.S. and occasionally a problem in the eastern U.S. Recently, roses in a wholesale nursery in a southern state were decimated by rust. Symptoms include faint yellow spots to green "islands" on upper leaf surfaces; signs are yellow-to-orange pustules on the lower leaf surface (Figure 8). Some rose cultivars tolerate rust; intolerant cultivars may completely defoliate with only one to a few pustules on leaves.

Rust is most severe in humid, cool weather. Although rust can be severe in western states bordering the Pacific Ocean each year, most of the country is spared consistent outbreaks of this disease due to hot temperatures in the summer and very cold temperatures in the winter, which inhibit rust survival.

Control is often achieved by removing infected leaves and canes with pustules. In locations with a history of rust, protectant fungicide sprays may be necessary. Some cultivars are more resistant or tolerant to rust than others.

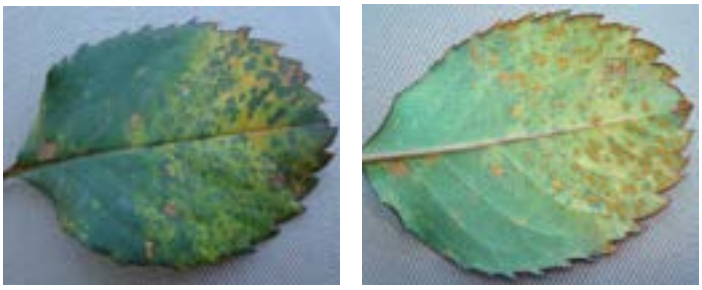


Figure 8. Symptoms and signs of rust on rose.

Stem Canker

Stem canker on rose canes (stems) are caused by several fungi including *Cryptosporella umbrina, Coniothyrium spp.* and *Botrytis cinerea.* Symptoms begin as small, elliptical, red-to-purple-brown lesions on canes that enlarge to 1-to-6-inch tan-to-brown cankers on stems (Figure 9). Canes may die rapidly above the canker. Signs of pathogens are small gray-to-black fungal fruiting bodies on canker tissue; or in the case of Botrytis, fuzzy, gray-to-brown growth on canes. Brown stem canker often occurs during winter months. Control is limited to pruning out cankers as soon as detected. Cankers tend to grow to the base of a node,

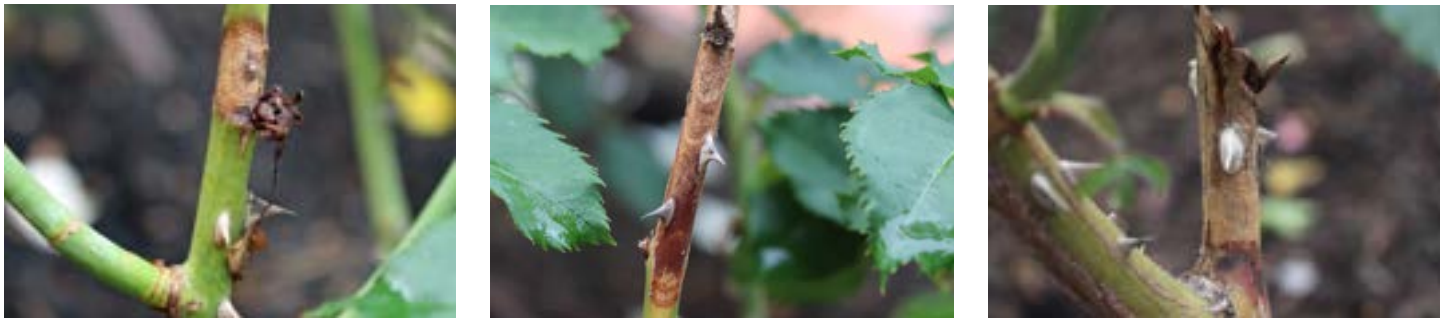


Figure 9. Stem cankers of rose.

so make pruning cuts as close to the top of a node as possible. Pruning cuts should also be at a slight angle that will prevent water from pooling on top of the wound. Use sharp bypass pruners to make pruning cuts. Do not use dull pruners or anvil-style pruners as crushing wounds from these pruners take longer to heal. Fungicides are not effective for management of canker diseases.

Armillaria Root Rot (ARR)

Armillaria root rot of rose can be caused by several species of the fungus *Armillaria*. This disease is becoming more prevalent in gardens across the U.S. Armillaria root rot is often found in rose beds near sites where a tree was removed. Symptoms include rapid decline of infected roses. Brown-to-honey-colored mushrooms emerge from the mulch at the base of the dying plant (Figure 10). Control of this disease is extremely difficult. Avoid planting roses in areas where clumps of honey mushrooms have appeared. Stump removal by grinding may not be sufficient to prevent ARR as large roots remain below the soil line. *Armillaria* spp. are soil inhabitants (live indefinitely in soil), and the fungus will invade more soil each year. When this happens, roses may die throughout the rose bed as the fungus moves out from its site of origin. Often, infested beds are returned to grass or used to plant herbaceous ornamentals.

*Figure 10. Clumps of honey mushrooms (*Armillaria*) growing on tree roots.*

Phytophthora Root Rot

This root rot can be caused by more than one species of *Phytophthora*. The disease may occur in roots, crown of the plant or stems in propagation. Symptoms include dark brown roots and stunted root systems. Aboveground symptoms include stunted plants. If root rot is severe, foliage may wilt (Figure 11).

Figure 11. Dark, decayed roots of rose infected with Phytophthora.

Although *Phytophthora* species are not true fungi and are more closely related to brown algae as are downy mildews, they are known as water molds. This disease is much more severe in poorly drained substrates or soils. If drainage is a problem, use raised beds with soils that will drain well (sandy soils). Do not over water rose beds. If Phytophthora root rot is severe, discard the plant. Planting back in the same hole may be futile if drainage issues are not corrected.

Crown Gall

Crown gall is a bacterial disease caused by *Agrobacterium tumefaciens*. Symptoms are galls (tumors) less than 1 to 4 inches in diameter on stems (often near pruning cuts), at the soil line (Figure 12), or on roots. Some cultivars can tolerate large and/or numerous galls without loss of vigor. Other cultivars are very intolerant and may decline rapidly with only one marble-sized gall. As galls age, they harden and appear to be woody (turn brown to black).

Agrobacterium tumefaciens is a soil inhabitant (the pathogen's population is stable in soil indefinitely). Digging up an infected plant and replacing the diseased plant with another plant may not yield a satisfactory result. An infested landscape bed can be abandoned and returned to grass. Carefully inspect all new plants, including roots, to ensure that this pathogen is not introduced into your garden. Crown gall can also be spread by pruning with bacteria-contaminated pruners. If you have had crown gall problems in the past, thoroughly clean pruners with a sanitizer such as 70 percent isopropyl alcohol, Lysol, etc., between pruning rose

bushes. Bleach (20-50 percent aqueous solution) is an effective sanitizer but may corrode metals and therefore dull pruners.

Figure 12. Mature crown galls on rose canes.

Rose Mosaic

There are more than 30 viruses known to infect roses. Only half of these viruses cause symptoms and/or affect growth of infected roses. Symptoms of virus infection include mosaic, mottled leaves, line patterns, ringspots, leaf curl or witch's broom (rosette) (Figure 13). Rose mosaic may be caused by one or more viruses in this group: Prunus Necrotic Ringspot Virus (PNRSV), Apple Mosaic Virus (ApMV) and Arabis Mosaic Virus (ArMV). Roses infected with a virus associated with rose mosaic may produce fewer blooms on shorter stems.

Rose viruses such as those that cause rose mosaic are disseminated via propagation of infected plants. Most rose viruses are not spread by pruning or by mite or insect vectors. However, there is limited information regarding the movement of ArMV by nematodes and PNRSV via pollen. To exclude rose mosaic from your garden, inspect plants for symptoms before purchase; don't bring a symptomatic plant home. Usually, rose mosaic does not spread to other roses in the garden. The National Clean Plant Network for Roses (NCPN-R) is an association of clean plant centers, scientists, educators, state and federal regulators, large and small nurseries, rosarians, and growers of garden and cut flower roses that act together to ensure the rose bud wood and rootstock is virus tested and available for propagators. The NCPN-R has been successful in minimizing the spread of rose mosaic in the rose industry.

Rose Rosette Disease (RRD)

This lethal disease of roses is caused by the rose rosette virus (RRV). Symptoms of the virus are variable and include mosaics, strapped leaves (usually thin), a profusion of shoots with short internodes on one cane (witch's broom or rosette), hyper-thorniness (profusion of thorns), thickened stems, reddening of foliage and stems, distorted buds and flowers, stem (cane) death, and plant death (Figure 14).

Figure 14. The most reliable symptoms for rose rosette identification are excessive thorns and the rosette (witch's broom).

Some large shrub roses can survive with the disease for many years. However, most plants symptomatic for RRD will decline and die in three to five years (Figure 15). Young plants may die in the first year of symptoms.

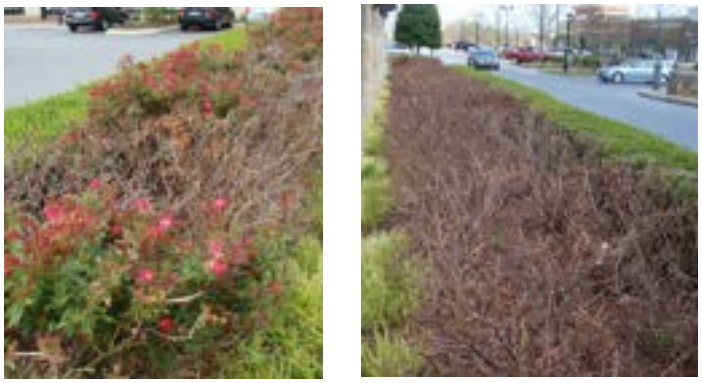


Figure 15. Roses infected with the rose rosette virus often die within three to five years.

Figure 13. Mosaic, vein clearing and line pattern symptoms caused by a plant virus infection.

The virus is transmitted by the eriophyid mite, *Phyllocoptes fructiphilus* (Figure 16). These mites are the size of dust particles and are only visible with a microscope (> 40X). The mite is wingless and has four legs and no eyes. When temperatures reach the mid-80s, mites will release themselves from their host plant and float in air currents (ballooning). Mites can survive up to five days off a host and be blown a considerable distance from the source plant. When *P. fructiphilus* females hatch, they lay eggs that yield only males as long as they are unfertilized. Once fertilized, females lay eggs that yield mostly females. During summer months, large populations of mites can develop on rose plants. Plants symptomatic for RRD may have as many as fortyfold more mites than healthy roses.

Figure 16. left: Microscopic eriophyid mites spread rose rosette virus; right: Mites (orange) and eggs (white) are visible on a rosebud sepal. Images have been colorized to enhance detail.

(Images courtesy of Gary R. Bauchan, director, Electron & Confocal Microscopy Unit USDA-ARS, Beltsville, MD.)

Rose rosette disease can also be spread from one location to another by movement of diseased plants. Infected plants may remain without symptoms (asymptomatic) for up to one year, and these plants are very difficult to detect until they are planted and display symptoms of RRD. When plants with symptoms are detected, bag the top of the bush to prevent movement of mites and cut the bagged bush off at the soil line. The root ball can be dug and discarded. Root systems do not have to be bagged as the mites do not live in soil. Pruning symptomatic foliage from an infected plant will not save a plant. When a symptomatic plant is removed, a new plant can be placed in the same location as soon as one week later. Success with the replacement rose is not assured as mites may be blown in from infected roses. Adjacent plants should be watched for several months to make sure they are not infected. If symptoms are detected in a neighboring plant, it should be removed. Prompt removal of infected plants will aid in keeping mite populations low and reduce movement within the garden. If the plant cannot be removed quickly, pruning of rosette(s) will reduce vector populations temporarily since mite populations are fortyfold or greater on rosettes than on asymptomatic tissues. However, removal of rosettes will not "cure" the plant and it will still need to be removed.

Multiflora rose is an exotic, invasive plant that is also a host of the virus and mite (Figure 17). This rose is often found along fence lines and forest edges in rural areas and can serve as a source of both the mite and virus. In urban areas, the greatest source of the mite and virus are large plantings of shrub roses that are infected with RRV and infested with mites.

Figure 17. To reduce the spread of rose rosette, remove multiflora rose in woodlands, fence rows and waste areas.

Some miticides have been proven to be effective in reducing the impact of RRD in roses. However, when to begin spraying and the interval between sprays is still unknown. Therefore, miticides cannot be recommended at this time. If a rose garden is free of symptomatic plants, but a population of symptomatic plants is upwind from the location, a barrier such as a privacy fence or tall vegetation may impede mite dissemination and aid in reducing the threat to the garden. Employees of state and federal laboratories and private rose companies are working together to develop resistant roses. However, there are no rose cultivars known to be resistant to RRV at this time.

Although RRD has killed thousands of roses in the eastern U.S., the disease is manageable. In the rose garden the following steps can reduce the threat of RRD greatly. The first steps are:

1. Know the symptoms associated with RRD (refer to UT Extension publication "SP 806 Early Detection of Rose Rosette Disease").
2. Remove any bush at first symptoms to prevent mite populations from building on the bush to levels where mites are moving to other bushes.
3. Wait at least one week before planting another bush into the hole left from the plant removal in step 2.
4. Carefully monitor bushes around the location of the plant that was removed.

Many gardeners have followed these steps and have successfully managed this disease.

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