

RASPBERRY ROOT DISEASES

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Understanding the root diseases of brambles

Root diseases are particularly devastating and frustrating to manage in small fruit production operations. This is especially the case for established operations because the most effective management practices must be implemented prior to planting. The pathogens causing root diseases are all soilborne and remain protected within the soil. In addition, the most diagnostic symptoms are also below ground, which prevents one from recognizing the problem at a time when action could be taken to save the planting.

In the region, the set of root diseases and disorders affect both raspberry also effects other crops such as strawberry. Hence, identifying the characteristics of these problems will help one understand their role in seasonal plant decline in several small fruit crops. This set of root diseases and disorders include:

1. **Winter Injury:** Decline from winter injury occurs when plants aren't well insulated against freezing during winter or when young tissue isn't protected against frost in the spring. Plants stressed by disease or abiotic factors prior to dormancy will be more susceptible to winter injury. Winter injury can result in reduced vigor and productivity, or kill plants outright. Winter injury to the roots can be diagnosed by cutting longitudinally through the crown of dying (not dead) plants. Initially, the cortex of affected roots and crown tissue will appear brown while the vascular tissue remains white and healthy. By contrast, most root diseases will preferentially affect the vascular tissue, and decay in the cortex occurs by secondary pathogens. During the season, winter injured plants will send up new canes that remain healthy through the season. By comparison, a root disease will cause decline of canes throughout the season. Cold injury during spring freezes is more frequently observed in the region and is quite diagnostic. The vascular connections in young floricanes become damaged causing them wilt and die during the spring while hardier primocanes flourish. This causes a planting to appear to have row tops of dead shoots, but healthy crowns and row bottoms.
2. **Drought Injury:** Periods of drought may injure plants or predispose them to winter injury or diseases. Drought for even a few weeks can cause young leaves to wilt and developing fruit to shrivel. Fine roots may die off and impaired root function may cause the plants to appear as if they are affected by a root disease. In addition, the use of fertilizers, herbicides, and pesticides (e.g. captan) during a drought may result in unexpected injury either from the association of drought conditions with heat, or the excessive need for the plants to uptake the water often used as a carrier in chemical applications. When excavated, a plant suffering from drought will have roots that are dry and sinewy, but still have white vascular tissues and cortex.

3. *Phytophthora* root rot: *Phytophthora* is an aquatic pathogen that prefers cool weather and free moisture (e.g. wet spots in the field). During *Phytophthora* infections, fine/lateral roots will decay first leaving only large primary roots. When the roots and crown are sectioned longitudinally, the affected tissues will be chocolate to reddish brown. As infection progresses and the plant dies, secondary decay fungi will rot the cortex of roots and the crown. Following plant death, infective propagules remain in dead plant tissue and the soil. These are capable of causing infections in later seasons after replanting. In general, red raspberry varieties are more susceptible to *Phytophthora* root rot than purple and black raspberry varieties.
4. *Verticillium* wilt: *Verticillium* wilt has the most distinctive symptoms of the root diseases presented here, and is easiest to diagnose. In raspberries, the youngest canes will wilt first beginning from the base to the tip. On such canes, the petioles will remain attached with the oldest leaves at the base looking scorched and youngest leaves at the tip looking stunted, but often still green. Infected raspberry canes may also have bluish streak-shaped lesions within infected canes. In general, purple and black raspberry varieties are more susceptible to *Phytophthora* root rot than red raspberry varieties.

The role of root diseases in plant decline during 2010 and 2011

In 2010, the early season was warm and dry, but considerable rainfall occurred from late July through September. There were many reports of small fruit plant decline, especially in strawberries and high tunnel raspberries. Unfortunately, the majority of the samples diagnosed by this program had progressed to a stage of decline where it was impossible to confirm root disease as the cause. Some samples provided clear indications of *Verticillium* wilt and signs of *Phytophthora* infected tissues, but others were simply winter injury. In 2011, the early season and late season had considerable rainfall with near flooding in some regions. Between these two periods there was a 1.5 month stretch of drought (i.e. < 1.0" of rain). There were numerous reports of *Phytophthora* root rot, but the majority became manifest in the presence of the drought when root function was most critical. During this period, we received reports and samples of chemical injury from fertilizer and pesticide use on drought stressed plants. In late season, there were more reports of *Phytophthora* root rot likely resulting from overly susceptible plants that had suffered from drought stress.

Preparing for root diseases and decline in 2012

Given the potential for high disease pressure and environmental stress in late 2010 and 2011, there could be considerable root disease in small fruit plantings in 2012. In plantings with severe plant decline in low-lying wet areas, a phosphorous fungicide program may be warranted to prevent additional loss to *Phytophthora*. In addition to diseases, winter injury could be more severe in 2012. Plants with high levels of disease (even foliar diseases like leaf spot) or recovering from drought stress as they enter dormancy may be more susceptible to winter injury in 2012. In order to avoid plant decline in 2012, producers should ensure plant insulation during winter and scout during spring and early summer for the first signs of plant decline (e.g. wilting). If recognized early enough, the extent of losses could be mitigated.

Literature

1. Pritts, M. and Handley, D. 1989. Bramble Production Guide. NRAES-35. Cornell cooperative Extension, Ithaca, NY, 200 p.
2. Ellis, M.A., Converse, R.H., Williams, R.N., and Williamson, B. 1991. Compendium of Raspberry and Blackberry Diseases and Insects. APS Press. 100 p.