College of Agriculture, Food and Environment
Cooperative Extension Service

Plant Pathology Fact Sheet **PPFS-GEN-21**

Rhizoctonia Diseases in Specialty Crop Production

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Importance

Rhizoctonia diseases primarily affect roots and stems of herbaceous plants, causing damping-off, stem rots, root rots, crown rots, and cutting rots. Additionally, foliar blights (also called web blights or aerial blights) can occur on herbaceous and woody plants. Plant tissues coming into contact with soil, such as fruit, tubers, and bulbs, can also become infected.

Hosts

Rhizoctonia diseases affect a broad and diverse range of plants. Specialty crop hosts include ornamentals (woody and herbaceous), vegetables, fruit crops, and hemp. Rhizoctonia diseases may also occur on agronomic crops (e.g., alfalfa, corn, grains, and tobacco) and turfgrass.

Symptoms & Signs

Damping-off

Damping-off can develop when seed is infected prior to planting (seed-borne) or when seed becomes infected after planting (soil-borne). Pre-emergent damping-off occurs when seedlings fail to emerge from the soil as a result of infection to the hypocotyl or radicle. Post-emergent damping-off occurs when seeds germinate, but seedlings collapse soon after emergence (Figure 1). Lesions on seedling roots and stems (hypocotyls) develop at the soil line and are often reddish-brown. Expanding lesions quickly girdle young, tender roots and stems, causing seedlings to wilt and die.

Wirestem

Wirestem affects seedlings that have survived post-emergent damping-off. It can develop on seedlings or on transplants after they are planted into the field. These plants may continue to grow but the stem at the soil line remains constricted and wiry (Figure 2). Plants with wirestem are often permanently stunted, off-color, and less productive than healthy plants. Affected plants may wilt and eventually die. Wirestem is most common on cole crops (crucifers/brassicas).

Figure 1. Rhizoctonia damping-off causes collapse of seedlings and can spread rapidly through closely spaced plants. (Photo: Mary Ann Hansen, Virginia Tech, Bugwood.org) **Figure 2.** Cole crops that survive post-emergent damping-off may develop wire stem. Note the constricted stem near the soil line (arrow). (Photo: Gerald Holmes, Strawberry Center, Cal Poly San Luis Obispo, Bugwood.org)

Figure 3. (A) Rhizoctonia root and stem rot infections begin at or below the soil line, developing reddish-brown to brown lesions that girdle roots and stems. (Photo: Cheryl Kaiser, UK) **(B)** Close-up of reddish-brown lesions typical of Rhizoctonia stem and root rot. (Photo: John Hartman, UK)

Cutting Rot

Ornamentals propagated from cuttings can decay when source plants are infected or potting media is contaminated. Foliage wilts, yellows, and eventually dies when a dry, brown basal rot develops. Cutting rot can occur before or after rooting.

Root & Stem Rot

Rhizoctonia root and stem diseases result in the formation of circular to elongate, dry, sunken lesions at or below the soil line (Figure 3A). Infections are most common on young plants; however, the disease can also occur on established plants. Infections often result from transplant wounds. Lesions are reddish-brown on some hosts (Figure 3B) and dark brown to black on others. Enlarging lesions girdle and kill roots and stems, causing above-ground portions of plants to weaken. Infected plants become stunted; leaves turn yellow and die. Rhizoctonia stem rot may also be referred to as sore shin (hemp) or Rhizoctonia canker (potato).

Crown Rot

Crown rot usually develops from root and/or stem infections but may also occur when infested soil comes into contact with crowns. Plants collapse as a result (Figure 4A).

Bottom rot (Figure 4B) is a crown rot disease primarily affecting leafy vegetables, such as cabbage and lettuce. It may develop on plants with wire stem, or new infections may be initiated when lower leaves come into contact with wet, infested soil. Initial dark brown, oval lesions expand until entire leaves droop, rot, and turn black. Infected leaves generally remain attached to plants. In severe cases, entire heads decay (head rot).

Figure 4. (A) Rhizoctonia crown rot can result in plant collapse. (Photo: Oliver T. Nehe, The Amalgamated Sugar Company, Bugwood.org) **(B)** Rhizoctonia bottom rot primarily affects leafy vegetables, causing dark brown lesions that expand until the entire head decays. (Photo: Gerald Holmes, Strawberry Center, Cal Poly San Luis Obispo, Bugwood.org)

Fruit Rot

Fruit rots develop when fruit comes into contact with infested soil on the ground or when infested soil is blown or splashed onto low-hanging fruit.

Belly rot most often occurs on cucurbits (especially cucumber) when vines trail along bare ground. Immature fruit develop a yellowish brown, superficial discoloration, while infections of mature fruit result in large water-soaked, decayed areas (Figure 5A). Lesions eventually become sunken, dried, irregular spots on fruit undersides or "belly." However, infected fruit remains firm, seldom succumbing to a soft rot.

Soil rot may occur on tomato fruit. If fruit are allowed to touch infested soil, a firm, leathery decay develops at the point of contact (Figure 5B). The decay later becomes soft and watery.

Figure 5. (A) Cucurbits are susceptible to fruit infections (belly rot), which begin as water-soaked lesions on the undersides of fruit and later become sunken and dried. (Photo: Cheryl Kaiser, UK) **(B)** Tomato fruit coming into contact with infested soil may develop Rhizoctonia soil rot. (Photo University of Georgia Plant Pathology, University of Georgia, Bugwood.org)

Web Blight

Web blight, also known as aerial blight or foliar blight, occurs when the fungus expands into upper plant tissues. Infected leaves develop large irregular spots; large parts of plants wilt and become necrotic (brown) as the fungus invades branches (Figure 6A). The pathogen can produce abundant mycelia (threadlike fungal strands), which are often visible as "webbing." The mycelia can be present between leaves, "stitch" leaves together, and attach leaves to branches (Figures 6B & 6C). Web blight is most common on beans, hemp, and herbaceous nursery crops.

Figure 6. (A) Web blight, also referred to as aerial blight, occurs when Rhizoctonia fungi expand into upper plant tissues. **(B)** Rhizoctonia fungal strands appear as "webbing" that traps infected leaves, so they cling to branches. **(C)** Web blight moves to the upper canopy of dense plants when conditions are wet. (Photos: Nicole Gauthier, UK)

Black Scurf

Black scurf affects potato tubers, resulting in the development of tiny black, irregularly shaped fungal resting structures (sclerotia) on skins (Figure 7). The sclerotia are superficial but not easily removed; potato flesh and storage life are not affected. Black scurf is one of the two phases of the Rhizoctonia disease affecting potatoes; the other phase is Rhizoctonia canker, a stem rot disease.

Figure 7. Black scurf, often referred to as the "dirt that won't wash off," results when black fungal structures (sclerotia) form on potato skins. (Photo: Gerald Holmes, Strawberry Center, Cal Poly San Luis Obispo)

Cause & Disease Development

Rhizoctonia diseases are caused by various species of the soil-borne fungus, *Rhizoctonia*. The most common species, *Rhizoctonia solani,* consists of various strains with differing host ranges and pathogenicity. These fungi persist in soil and crop debris as mycelia (fungal strands) and sclerotia (1 to 3 mm, black-to-brown, irregularly shaped survival structures, which can persist up to 6 years in soil). *Rhizoctonia* fungi do not produce asexual spores (e.g., conidia), and rarely produce their sexual stage (basidiospores).

Rhizoctonia spp. are present in most soils, but populations can increase over time if disease is poorly managed. The fungus may be spread in field plantings when soil particles are blown or splashed to susceptible tissues. Introduction into greenhouses and nurseries occurs when infested soil particles are carried into plantings on dirty tools, pots, and equipment, via contaminated potting media, and through infected plant material. Web blight spreads when fungal inoculum (portions of the pathogen capable of initiating infections) or infected leaf tissues are blown to nearby plants.

Rhizoctonia fungi favor warm temperatures (70°F to 90°F) and high moisture levels. Seeds planted into cold soils, which delays germination, are more vulnerable to damping-off. Disease susceptibility is reduced as plants mature. Crowded flats, closely spaced pots, and maturing plants with dense canopies allow foliage to remain wet for prolonged periods, favoring disease development. In some cases, symptoms can be evident within 24 hours of infection, and because *Rhizoctonia* spp. can move rapidly through plantings, severe damage can occur in a week or less.

Disease Management

Cultural Practices

The key to managing Rhizoctonia diseases is prevention.

General

- Select cultivars that are resistant, tolerant, or less susceptible to Rhizoctonia diseases. For example, avoid highly susceptible cv. Kentucky Wonder pole beans and cv. White Half Runner beans if field has a history of disease.
- Purchase certified disease-free seed or disease-free transplants.
- Purchase treated seed to provide up to 4 weeks of protection or treat seed with a fungicide to protect against seed decay.
- Space plants to avoid overcrowding and to provide good air circulation.
- Follow good sanitation practices, such as removing and destroying infected plant material, washing or disinfecting tools and equipment, and managing weeds.
- Avoid overhead irrigation and avoid overwatering.
- Take steps to prevent the movement of infested soil or potting media from one location to another.
- Avoid handling or working in plantings when conditions are wet.
- Rotate to a resistant or tolerant cultivar/species for a minimum of 3 years to help reduce inoculum levels (amounts of fungal infective material) in the soil. Cole crops (crucifers/brassicas) are more tolerant than most other crops to in-field infections, and legumes (beans) are often the most susceptible.
- Use soil solarization to reduce, and potentially destroy, inoculum. This technique requires covering the ground with clear plastic to increase soil temperatures to 110°F or greater for 2 to 4 weeks. Research is ongoing to determine solarization recommendations for Kentucky climates.

In fields, gardens & landscapes

- Select a well-drained site or plant into raised beds.
- Plow under cover crop 4 to 6 weeks prior to planting to allow sufficient time for decay. Plants in the cole crop family (crucifers/brassicas) are often tolerant or moderately resistant to Rhizoctonia diseases; select a brassica cover crop when possible. If using a small grain as a cover crop, avoid wheat since it has been shown to provide a "food source" for *Rhizoctonia* spp. Deep plow to 6 inches.
- Plant after soil has warmed to encourage rapid seed germination and more vigorous seedlings.
- Train vining vegetables on a trellis system to prevent fruit from contacting soil.
- Cover bare ground with wood mulch, black plastic, or landscape cloth to provide a barrier between soil and aboveground plant tissues.
- Prune woody ornamental branches to improve air circulation in plant canopies.

In nurseries & greenhouses

- Use new potting mixes. Avoid using natural soil or re-using potting media.
- Use pots and flats that are new. If containers must be re-used, wash thoroughly and disinfect.
- Avoid setting pots on the ground unless a soil barrier (e.g., plastic mulch) is present. Landscape cloth is not a sufficient barrier.
- Increase air circulation by venting structures and/or using fans.

Fungicides

Managing Rhizoctonia diseases should never be based on the use of fungicides alone. When they are used, fungicide sprays or drenches are only effective when applied as protectants. Contact your local county Extension office for current recommendations. Vegetable growers may also refer to *Vegetable Production Guide for Commercial Growers* (ID-36) and the *Southeastern U.S. Vegetable Crop Handbook.*

Additional Resources

Disease Fact Sheets

- Damping-off of Vegetables & Herbaceous Ornamentals (PPFS-GEN-03)
https://plantpathology.ca.uky.edu/files/ppfs-gen-03.pdf
- Fruit Rots of Cucurbits (PPFS-VG-07)
https://plantpathology.ca.uky.edu/files/ppfs-vg-07.pdf
- Garden Mum Production: Diseases and Nutritional Disorders
https://plantpathology.ca.uky.edu/files/ppfs-or-h-10.pdf

Production & Disease Management Guides

- Home Vegetable Gardening in Kentucky (ID-128)
http://www2.ca.uky.edu/agcomm/pubs/id/id128/id128.pdf
- Homeowner's Guide to Fungicides (PPFS-GEN-07)
https://plantpathology.ca.uky.edu/files/ppfs-gen-07.pdf
- Managing Diseases of Herbaceous Ornamentals (PPFS-OR-H-01)
https://plantpathology.ca.uky.edu/files/ppfs-or-h-01.pdf
- Managing Greenhouse & High Tunnel Environments to Reduce Plant Diseases (PPFS-GH-01)
https://plantpathology.ca.uky.edu/files/ppfs-gh-01.pdf
- Relative Effectiveness of Various Chemicals for Disease Control of Ornamental Plants (PPFS-GEN-1)
https://plantpathology.ca.uky.edu/files/ppfs-gen-13.pdf
- Soil Solarization for High Tunnels
https://www.uky.edu/hort/sites/www.uky.edu.hort/files/documents/solarization.pdf
- Southeastern U.S. Vegetable Crop Handbook
https://www.aces.edu/blog/topics/vegetable-crops/southeastern-us-vegetable-crop-handbook/
- Vegetable Production Guide for Commercial Growers (ID-36)
http://www2.ca.uky.edu/agcomm/pubs/id/id36/id36.pdf
- Woody Plant Disease Management Guide for Nurseries & Landscapes (PPFS-OR-W-29)
https://plantpathology.ca.uky.edu/files/ppfs-or-w-29.pdf

Sanitation

- Cleaning & Disinfecting Home Garden Tools & Equipment (PPFS-GEN-17)
https://plantpathology.ca.uky.edu/files/ppfs-gen-17.pdf
- Cleaning & Sanitizing Commercial Greenhouse Surfaces (PPFS-GH-07)
https://plantpathology.ca.uky.edu/files/ppfs-gh-07.pdf
- Fruit, Orchard, and Vineyard Sanitation (PPFS-GEN-05)
https://plantpathology.ca.uky.edu/files/ppfs-gen-05.pdf
- Greenhouse Sanitation (PPFS-GH-04)
https://plantpathology.ca.uky.edu/files/ppfs-gh-04.pdf
- Landscape Sanitation (PPFS-GEN-04)
https://plantpathology.ca.uky.edu/files/ppfs-gen-04.pdf