



# AGRONOMIC SPOTLIGHT



## SEEDLING AND ROOT DISEASES OF BEANS

- » Diseases that attack seedlings and root systems of bean plants can result in significant yield losses.
- » Several soilborne fungal and water mold pathogens infect bean seedlings and root system.
- » Disease management strategies include crop rotation, seed treatments, selection of appropriate planting times and locations, soil management practices, and the use of disease resistant varieties when available.

### SEEDLING AND ROOT DISEASES

Seedling blights, damping-off, and root rots are caused by a number of pathogens including *Aphanomyces euteiches* and several species of *Pythium* (fungal-like water molds), the fungal pathogens *Rhizoctonia solani* and *Fusarium solani* f. sp. *phaseoli*, and several species of root knot nematode. These pathogens reside in the soil and are spread by anything that moves soil, including equipment, animals, and water flowing through infested fields.

### PYTHIUM DISEASES

Several species of *Pythium* cause seed rots, pre- and post-emergence damping-off, stem and root rots, and even some pod rots. Losses can be as high as 100% when the disease is severe.<sup>2</sup> Infections of root systems cause slightly sunken, tan lesions that coalesce. Both primary and secondary roots are affected, resulting in a wet, soft rot of large portions of the root system. Seedlings become stunted, wilt, and may eventually “damp-off” (Figure 1).<sup>2</sup> Under certain conditions, *Pythium* can splash up into the canopy and infect pods, resulting in lesions that start at the tips of the pods and progress towards the stem end.<sup>3,4</sup>



Figure 1. Post-emergence damping-off caused by *Pythium* sp. University of Illinois Extension.

*Pythium* belongs to the water mold group of fungal-like organisms that thrive in wet conditions. So *Pythium* diseases typically occur following periods of high soil moisture. Some species of *Pythium* are favored by cool temperatures, while others do best in warm conditions.

Resistance is available in beans, but it is currently used in only a few commercial cultivars. To control this disease, plant beans in fields with well drained soils, use wide

spacings between plants, and avoid over-irrigating during the seedling stage. Seed treatments and/or pre-plant (in furrow) soil treatments with fungicides containing mefenoxam can be effective.<sup>5</sup> Avoid planting in fields with a history of the disease. Crop rotations with cereal crops can help prevent a buildup of the pathogens.<sup>2</sup>

### APHANOMYCES ROOT ROT

Like *Pythium*, *Aphanomyces* belongs to the water mold group of organisms that thrive in wet conditions. Infection can occur at any time during the growing season, often just after seedling emergence. The disease can develop over a wide range of temperatures but does best between 68 and 82 °F. Saturated soils predispose roots to infection and are needed for the swimming spores of the pathogen to move to plant roots. The disease is most severe in locations with poor soil drainage, compacted soils, high clay content, or that receive excessive irrigation. Once in a soil, spores of the pathogen can remain viable for up to ten years.<sup>5</sup>

The initial symptoms of *Aphanomyces* root rot are gray, water-soaked roots that become soft and brown to black. Root systems become small and non-functional, resulting in wilting, chlorosis, and necrosis of above ground plant parts. Infected root systems have reduced levels of *Rhizobium* root nodulation. The root lesions can extend upward onto the hypocotyls (lower stems). Seedlings become stunted and less competitive, but rarely die (damp-off).<sup>5</sup> The most severe symptoms are seen when dry conditions occur after a wet period that is conducive for infection.

Good resistance is available for *Aphanomyces* root rot in commercial bean cultivars, and resistance is one of the best methods for managing this disease. Management strategies should also include avoiding heavily infested fields, and practices that promote good soil drainage. Crop rotation and the use of fungicides have not been very effective. However, the use of cover crops, particularly cruciferous species (e.g. mustard and radish) have been shown to help control *Aphanomyces* root rot.<sup>5</sup>

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# SEEDLING AND ROOT DISEASES OF BEANS

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## RHIZOCTONIA ROOT ROT

The fungus *Rhizoctonia solani* can also attack bean plants at any time during the growing season. However, it is most important as a seed decay and seedling damping-off pathogen. Infection by *R. solani* results in sunken, reddish colored lesions on the lower stems and tap roots of older plants (Figure 2). These lesions can girdle roots and stems, killing roots and weakening plants.<sup>3,4</sup>



Figure 2. Rhizoctonia lesions on bean hypocotyls. University of Illinois Extension.

Rhizoctonia root rot is most severe at temperatures between 60 and 65 °F, with the size and number of lesions reduced above 70 °F. Soil moisture levels have little effect on disease development. However, the disease is more severe in areas with compacted soils. Plants are most

susceptible in the seedling stages, and infections on plants more than four-weeks old

usually have little impact on yield.<sup>2</sup>

Seed treatment and soil applied fungicides containing azoxystrobin, PCNB, or fludioxonil can be used to manage Rhizoctonia root rot.<sup>4</sup> Cultural practices that encourage rapid emergence, such as planting in warm soils and shallow planting, can be used to reduce disease severity.

## FUSARIUM ROOT ROT

Symptoms of Fusarium root rot include reddish lesions on the tap root and lower stem that can enlarge and coalesce to rot the entire root system (Figure 3).<sup>1</sup> Plants become stunted, and plant death can occur. However, adventitious roots can form above the lesions, keeping plants alive.

Fusarium root rot is favored by warm (72 to 90 °F), wet conditions and acidic soils. Compacted soils and infection by *Pythium* or nematodes can increase disease severity.<sup>1</sup>



Figure 3. Reddish root discoloration from Fusarium root rot. Howard F. Schwartz, Colorado State University, Bugwood.org.

Resistance to *Fusarium* is not readily available in commercial bean varieties. Cultural practices, such as proper fertilization, adjusting soil pH levels, and

alleviating soil compaction can help reduce disease levels. Seed treatment fungicides containing fludioxonil can protect seedlings from infection.<sup>1,2,4</sup>

## ROOT KNOT NEMATODE

Root knot of beans is caused by several species of the root knot nematode. *Meloidogyne hapla* is found in colder regions of the U. S. and other *Meloidogyne* species predominate in warmer areas. The disease is more common in the southern parts of the U. S. than it is in the north. Severe infections can result in yield losses of up to 90%. The disease is most severe in sandy, well-drained soils at temperatures between 77 and 86 °F.<sup>1</sup>

Infected roots become swollen as root galls up to ½ inch in diameter develop on both primary and secondary roots



Figure 4. Root gall symptoms of root knot nematode infection. Howard F. Schwartz, Colorado State University, Bugwood.org.

(Figure 4). Roots are shortened and thickened, and the over all root system size is reduced. Above ground symptoms include yellowing, stunting, and wilting of stems and leaves.<sup>2,6</sup>

Rotation with cereal crops, deep plowing, and soil flooding can help lower inoculum levels of the

nematode.<sup>2</sup> High levels of resistance to root knot are not available in commercial snap bean varieties; however some varieties are reported to have low levels of resistance. Fumigant and non-fumigant nematicides can be used to lower nematode levels, but the use of these products may not be economically justified, and environmental and worker safety factors need to be considered.<sup>6</sup>

### Sources:

<sup>1</sup> Hagedorn, D.J. and Inglis, D.A. 1986. Handbook of bean diseases. A3374. University of Wisconsin-Extension.

<sup>2</sup> Schwartz, H.F., Steadman, J.R., Hall, R., and Forster, R.L. 2005. Compendium of bean diseases; second edition. American Phytopathological Society, St. Paul, MN.

<sup>3</sup> Seebold, K.W. 2014. Bean diseases. Plant Pathology Fact Sheet, PPF5-VG-16. University of Kentucky.

<sup>4</sup> Reiners, S. et al. 2016. Cornell integrated crop and pest management guidelines for commercial vegetable production.

<sup>5</sup> Huges, T.J. and Grau, C.R. 2013. Aphanomyces root rot or common root rot of legumes. The Plant Health Instructor. DOI: 10.1094/PHI-1-2007-0418-01.

<sup>6</sup> Noling, J.W. 2015. Nematode management in beans and peas (bush, beans, pole beans, lima beans, southern peas, English peas, Chinese peas, or snow peas). University of Florida-IFAS. INY-020.

**For additional agronomic information, please contact your local seed representative. Developed in partnership with Technology Development & Agronomy by Monsanto.**

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