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## Phytophthora diseases of vegetables

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### Quick Facts

Phytophthora diseases can affect many vegetable crops including peppers, tomatoes, melons, squash, pumpkin, eggplant, cucumber and carrots.

The soil-borne fungus is favored by high humidity and temperature, standing water and soil compaction.

The pathogen can survive in infested debris, soil and seed.

Disease management involves crop rotation, clean seed and transplants, proper seedbed preparation, cultivation practices, irrigation procedures, fungicides, and other production guidelines that reduce plant stress.

slight to 100 percent, depending on factors that influence disease development.

### Pathogen Survival and Disease Development

The pathogen thrives in heavy, wet soil. Fungus spores are motile in the water film surrounding soil particles, and can swim or be moved down rows and between beds. Spores can be blown by wind, and splashed onto plant parts during a storm or irrigation. The fungus also can be transported on or in seed, contaminating soil particles that adhere to roots of transplants. Infection is favored by high humidity and temperatures greater than 86 F, soil compaction and standing water.

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This information provided by:

Phytophthora diseases of vegetable crops have been known in Colorado for more than 50 years. Phytophthora capsici was isolated from infected peppers in the Arkansas Valley in the 1930s, and continues to be a serious problem. The pathogen has a wide host range and includes all types of peppers, melons, squash, pumpkin, eggplant, cucumber, tomato and carrots. The pathogen can cause damping off, foot rot, root rot, leaf blight, petiole and stem infection, and fruit rot. Losses vary from

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1. Colorado State University Cooperative Extension plant pathologist and professor; plant pathology and weed sciences. 12/92. ©Colorado State University Cooperative Extension. 1994. For more information, contact your county Cooperative Extension office.

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## Symptoms

Phytophthora infection on peppers may appear initially on leaves as small, circular to irregular dark green, water-soaked spots. As the spots enlarge, affected areas appear sunscalded, dried and bleached. Root and stem infection can occur at or near the soil line as a dark green, water-soaked, mushy area that eventually turns brown and girdles the stem causing plant wilt and death.



**Phytophthora infection on zucchini.**



**Phytophthora wilt on peppers.**

The pathogen progresses along plant vascular bundles and pith tissue. Branch infection may extend to petioles, leaves, blossoms or fruit that can become covered by a white moldy growth during high moisture periods. Infected fruits dry, remain attached to the plant and become mummified. Infected seed turn dark and shrivel. Similar symptoms occur on other vegetables such as squash.

Phytophthora infection of tomato fruits is called buckeye rot. A green to brown water-soaked spot develops near the blossom end of the fruit, especially if it is in contact with moist soil. When the rot develops slowly, definite zonations or dark concentric rings form

in the decayed area of the fruit. A soft rot may develop from secondary bacterial invaders. A premature ripening or fruit-drop also may occur on infected eggplant. Tomato roots may exhibit brown lesions and xylem, or become girdled, rot off and give off a musty odor.

## Disease Management Recommendations

Soil-borne problems of vegetable crops are managed, but not eliminated, by using carefully implemented and integrated approaches to crop production and protection. These approaches reduce disease pressure and plant stress, thereby enabling vigorous plants to compete more successfully for nutrients and moisture during plant and fruit development. This section summarizes disease management strategies commonly recommended.

Residual populations of phytophthora can be reduced effectively by following a crop rotation of three or more years. A vegetable crop can be included every third year; however, less frequent plantings are beneficial in fields with a history of the disease. Non-host crops such as small grains and corn are recommended.

Incorporate crop debris well into the soil by deep plowing or other methods. Alleviate soil compaction and poor drainage by chiseling and working the soil when the moisture content is not too high. Raised plant beds promote good drainage and minimize the opportunity for free water (and spores) to contact plant stems during the season. New Mexico growers use a furrow-ridge method of production that gradually hills up the plants with each cultivation. By the last cultivation, plants are on ridges 10 to 12 inches high. Clean cultivation equipment and other tools thoroughly before moving to other fields.

Plant high quality, disease-free seed and transplants to maximize plant vigor and stand establishment. Treat seed with fungicides to protect seed and seedlings from early season infection. Arasan and Captan are labeled for use, and other products are being evaluated for future use. Other fungicides are applied every seven to 14 days to protect foliage, stems, branches and fruits from infection later in the season. Products such as Ridomil MZ58 are under experimental evaluation. It is important to provide total plant coverage, especially near the soil line. Timely applications of fungicides combined with other management practices should reduce disease losses. Fall fumigation of soil is costly but can effectively reduce pathogen survival and disease losses.

Follow fertility recommendations carefully and avoid excess amounts of nitrogen, especially after fruiting begins. Schedule irrigations to provide sufficient water to plants without causing moisture stress or excess. Do not allow plants to stand in water because phytophthora losses are proportional to the number of hours that plants remain in water-logged soil. Manage weeds and insects, and avoid root pruning during cultivation to minimize plant stress or wounds through which the pathogen can invade. There are sources of phytophthora resistance available in some vegetables like tomatoes. Hopefully resistance will be incorporated in new pepper varieties someday.

Finally, it must be emphasized that phytophthora can be successfully managed if the producer integrates the recommended strategies of crop rotation, clean seed and transplants, proper seedbed preparation, cultivation practices, irrigation procedures, fungicides and other production guidelines that reduce plant stress.