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# Importance of Early Blight of Potato Induced by (*Alternaria solani*) and Its Management

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## Abstract

Potato is an important vegetable crop in terms of quantities produced and consumed worldwide. Potato early blight disease, caused by two species of genus *Alternaria* (*A. solani* and *A. alternata*), is the major threat to potato production in the world. Early blight of potato is prevalent worldwide wherever potato is grown. In India it is more common than late blight and may cause up to 40% loss in yield. Management of early blight is too difficult because it produces huge amount of secondary inoculums. Using good cultural practices and applying chemical fungicides are important in managing of early blight disease of potato. Even though there is no well developed biological control of early blight, it is very important to develop such management strategies; because biological control measures are specific, efficient and environmentally safe. In current article we are highlighting its importance and some tools for managing effectively.

## Introduction

The potato is encountered by more than a hundred diseases caused either by bacteria, fungi, viruses or *mycoplasms*. However, early blight caused *Alternaria solani* is one of the most important foliage diseases in areas with favorable weather conditions. Potatoes become infected with early blight when foliage has become excessively wet due to rain, fog, dew or irrigation. Although not a terminal disease, severe infections can be fairly detrimental. In contrast to its name, early blight rarely develops early; it usually affects mature foliage rather than young, tender leaves. Disease is caused by two species of genus *Alternaria* (*A. solani* and *A. alternata*), occurs worldwide on potato crops, particularly in the regions with high temperature and alternating periods of dry weather and high humidity and/or irrigated potato soils, light-textured, sandy, and low in organic matter. Early blight is a very common disease of both potato and tomato. It causes leaf spots and tuber blight on potato.

It is very difficult to manage early blight because of it has capacity to produce huge amount of secondary inoculums. Yield losses caused by the disease are reported 5-50 %. Losses caused by early blight can be minimized by timely and appropriate application of fungicides. Cultural control measures such as using proper harvesting and storage practices, can be used to reduce the pathogen populations. Most approaches to control of foliar early blight have depends on the use of protectant fungicides during the warm-hot weather, but the criteria used to determine proper time of initial fungicide have varied widely caused unnecessary sprays. The objective of this review is the economic importance of early blight of potato crop disease and its management option.

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## Geographic Distribution of Early Blight

Early blight (EB) can be found in many potato growing regions of the world and belongs to one of the most common and widespread diseases in potatoes. In India disease is known to occur in Haryana, Punjab, Uttar Pradesh, West Bengal, Bihar, Uttarakhand and Assam. Due to its high adaptability, early blight has the potential to become a serious threat for potato cultivation. Early blight of potato, caused by the fungus *Alternaria solani*, is prevalent worldwide wherever potatoes, tomatoes, peppers, and eggplant are grown. The disease can damage both potato foliage and tubers. The disease is also a common problem on tomatoes. The name early blight is misleading, as the disease normally appears first on plants where the tuber crop is setting or where tubers have already formed. Actively growing young tissue and plants heavily fertilized with nitrogen, do not exhibit symptoms, and most secondary spread occurs as plants age, especially after blossoming or at plant attains towards maturity.

## Importance of Early Blight

Disease mainly affects potato foliage and leads to leaf necrosis and premature defoliation. The primary damage of early blight is due to premature defoliation of the plant. There is an increase in Photosynthesis rates and decrease in respiration rates apparently healthy tissues. Physiological changes are difficult to measure and evaluation of crop loss is based on the level of disease. Early literature cites yield losses of 5–50 %. There is often a discrepancy between damage to foliage and yield loss, which is due to the increase in disease spread at the end of the season, when most of the yield has been produced the potato tuber becomes infected, the quantity and quality of marketable produce is decreased.

Most rapid spread of the disease occurs when alternating wet and dry weather prevails during crop season. The disease is often most severe when potato plants are predisposed by injury, poor nutrition, or other type of stress. Besides attacking tomatoes peppers, and eggplant, the causal fungus also infects garden petunia, apple-of-Peru or shoo-fly-plant, spiny amaranth or pigweed, Chinese amaranth, small flowered galinsoga as well as other ornamental and weed species of *Solanum.*

## Symptoms

Symptoms of the disease initially observed on older, senescing leaves. First symptoms usually appear on older leaves and consist of small, irregular, dark brown to black spots. As the spots enlarge, concentric rings may form as result of irregular growth patterns by the organism in the leaf tissue. This gives the lesion a characteristic “target-spot” or “bull’s eye” appearance. There is often a narrow, yellow halo around each spot and lesions are usually bordered by veins.

When disease progresses the spots are numerous, they may grow together, causing infected leaves to turn yellow and die. Usually the oldest leaves become infected first and they dry up and drop from the plant. Brown, angular, necrotic spots marked internally by a series of concentric rings form on leaves and to a lesser extent on stems.

Symptoms include characteristic concentric rings that appear dark and sunken and become papery. Lesions enlarge, coalesce and cause leaf death. Initial infection usually occurs on the older, lower leaves then progresses up the plant.

Lesions first appear as small spots-dry and papery in texture. Lesions become brownish black and circular as they expand. Older lesions often appear angular in appearance as their margins become limited by leaf veins. Infected stems show sunken, elongated spots that may also display the typical concentric rings. Lesions in tubers appear as slightly sunken dark irregular spots with raised borders; a dry rot develops internally under the skin. On potato tubers, early blight results in surface lesions that appear a little dark. Internally, the tissue shows a brown to black corky, dry rot, usually not more than $^{1}/_{4}$ to $^{3}/_{8}$ inch deep (Figure 1).

Figure 1: Early blight lesions initially appear as small, circular to irregular dark-brown spots on older (lower) leaves

Similar to early blight, brown spot causes small, dark lesions on lower leaves. However, brown spot lesions, do not develop dark concentric rings characteristic of early blight infection, and unlike early blight lesions, also may coalesce across large veins.

Elongated, brown to black lesions may develop on the stems and petioles of infected plants (Figure 2).

## The Pathogen

Early blight is caused by the fungus, *Alternaria solani*, which survives in infected leaf or stem tissues on or in the soil. This fungus is universally present in fields where these crops have been grown. It can also be carried on tomato seed and in potato tubers. Spores form on infested

plant debris at the soil surface or on active lesions over a fairly wide temperature range, especially under alternating wet and dry conditions. They are easily carried by air currents, windblown soil, splashing rain, and irrigation water. Infection of susceptible leaf or stem tissues occurs in warm, humid weather with heavy dews or rain.

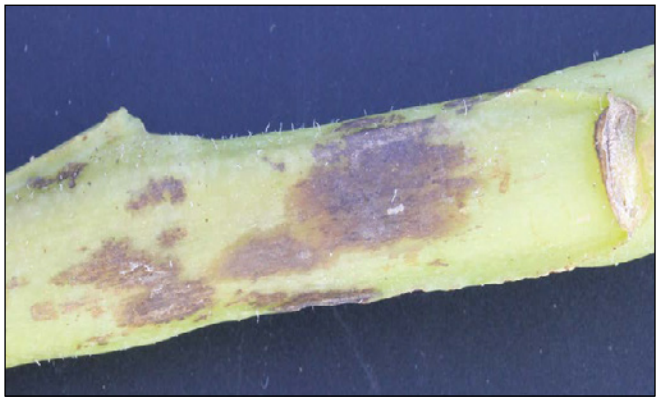

Figure 2: Infection on Stems

This fungus produces dark to black conidia (asexual spores). This fungus has not been found to produce sexual spores. *Alternaria* spp. have dark-colored mycelium, and in older diseased tissue they produce short, simple, erect conidiophores that bear single or branched chains of conidia. Conidia are large, dark, long, or pear shaped and multicellular, with both transverse and longitudinal cross walls. Conidia are detached easily and are carried by air currents. *Alternaria* occurs on many plant/ crop species throughout the world. Their spores are present in the air and dust everywhere and are one of the most common fungal causes of hay fever allergies (Figure 3).

Figure 3: Spores of Alternaria solani

## Diseases Cycle

*Alternaria solani* is a polycyclic pathogen, as many cycles of infection are possible during a season. Primary infections on new plantings of potatoes or tomatoes are caused by overwintering inoculum. The pathogen overwinters as mycelium or conidia in plant debris, soil and infected tubers or on other host plants of the same family. The early blight fungus overwinters in the field on infected plant debris from the previous season's crop.

The pathogen survives primarily on infected crop debris, in soil for years. It can also overwinter on volunteer hosts and weeds. *Chlamydospores* have also been reported as a source of overwintering inoculums for early blight, allowing the pathogen to survive cold temperatures in or on the soil. The inoculum remains infective in debris in uncultivated soil for 5 to 8 months. The dark pigmentation of the hyphen increases their resistance to lyses. Spores survive most frequently in infected debris and seed and best in dry, fallow fields.

## Management of Early Blight

The disease is controlled primarily through the use of cultural practices, resistant cultivars and foliar fungicides. Cultural practices, such as crop rotation, removal and burning of infected plant debris. Use certified seed and resistant varieties.

Avoid irrigation in cool cloudy weather. After harvest, plow under all plant debris and volunteer potatoes or solanaceous crops and weeds. Select well drained and well aerated fields, avoid nitrogen and phosphorus deficiency. Avoid injury and skinning during harvest. Rotate fields to non-host crops for at least three years (three to four-year crop rotation).

Spray the crop by Mancozeb @ 0.2 percent or Difolatan 0.2 percent or Difenoconazole @ 0.1 percent. Repeat the spray after 7-10 days of interval.

## Conclusion

Potato is the fourth most important vegetable crop in terms of quantities produced and consumed worldwide. However, its production is currently threatened by a number of biotic and abiotic constraints. Potato early blight disease, caused by two species of genus *Alternaria* (*A. solani* and *A. alternata*), is the major bottleneck in potato production in the world as well as in Ethiopia. Early blight of potato is prevalent worldwide wherever potatoes, tomatoes, peppers, and eggplant are grown. The disease can damage both potato foliage and tubers and can causes yield losses of 5-50 %. Early blight is a poly cyclic disease that can cause more than one disease epidemics within a single cropping season. It is difficult to manage because of its capacity to produce huge amounts of secondary inoculums. Since the disease is very important in causing economic losses of yields on potato crop, developing and using effective and appropriate management options is unquestionable. Using good cultural practices and applying chemical fungicides are important in reducing as well as managing of early blight disease of potato. Even though there is no well developed biological control of early blight, it is very important to develop such management strategies;

because, biological control measures are specific, efficient and environmentally safe.

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