# LATE BLIGHT IN CENTRAL WASHINGTON

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Late blight is one of the most devastating diseases of potato. It is most destructive where large acreages are grown and cool, moist weather favors crop production as well as the disease causing fungus, Phytophthora infestans. Phytophthora means "plant destroyer".

The problem is an old one and occurs in nearly all areas of the world where potatoes are grown commercially. By the mid-nineteenth century, late blight had reached epidemic proportions in Europe. The resulting famine lasted for fifteen years and accounted for over a million deaths. It also prompted the emigration of nearly one and a half million Europeans to North America.

Late blight was first identified in central Washington in 1947. The second report did not occur for 27 years, when late blight rotted Washington grown tubers stored the fall of 1974 near Hermiston, Or. Thus inoculum was present in 1973.

In 1975 two sites were identified in Walla Walla County and a third near Paterson. All three were cultivated under center pivot irrigation. This epidemic resulted from the use of infected seed the previous years (1973, 1974), the presence of infected volunteer plants following the mild winter of 1974-1975, and mid-summer rains. Mild levels of the disease continued in 1976 and 1977, then seem to disappear after the severe winter of 1978-1979.

Late blight next occurred in 1982 and again in 1990. In both years, August rains provided the optimum environmental conditions for the fungus to rapidly develop. Inoculum was probably provided by the many potato volunteers that survived the preceding mild winter.

Although the next winter was cold and froze many unharvested tubers, late blight again developed in 1991. Symptoms were observed in early July following a cool, wet June. When normal summer temperatures occurred and precipitation declined, the incidence of late blight apparently decreased. However, tuber rot has occurred this winter in storage. Tubers were infected during harvest from fields that had incomplete vine death and/or foliar symptoms during the growing season.

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When discussing management it is important to consider the biological components and environmental conditions necessary for disease development. First a susceptible host must be present. Potato breeders are continually attempting to develop late blight-resistant varieties. Success has been limited by the presence of many races or strains of Phytophthora. Currently there are no completely resistant commercial varieties.

The clonal nature of seed stocks is also of concern, especially in areas dominated by a monoculture of one or two varieties. Columbia Basin acreage has increased since 1980 and production is dominated by 'Russet Burbank' (70%). Thus a large population of genetically similar plants is present each season. This is a potentially dangerous situation for disease development if a particularly aggressive strain of the fungus is present.

The favorable conditions for late blight, extended periods of cool and wet weather, are explained by the biology of the fungus. It requires high moisture (ambient relative humidity [RH] > 90%) and cool temperatures to infect, grow and increase. Between 60° and 70°F, also the ideal temperature for potato plant growth, the fungus rapidly produces spores on the foliage. The spores germinate and infect new leaves if free moisture (rain, dew, sprinkler irrigation) is present. Temperature at this point is critical. If temperatures are > 60°F each spore germinates and causes a new lesion. However, at 50°-60°F each spore can divide into six to eight swimming spores rapidly increasing inoculum.

The ideal conditions for a severe outbreak would be night temperatures of 50° to 60°F, accompanied by free moisture, followed by 60°-70°F day temperatures over a period of at least four to five days. These conditions are more typical in western Washington production areas and late blight is always a concern. In the arid climate of central Washington, late blight should be of minor or no importance. This is true with traditional rill irrigation. However, the shift to sprinkler irrigation, specifically center pivot systems, has dramatically impacted cultural practices and the occurrence of late blight.

The increase in center pivot use has provided a continual source for the free moisture and high RH required by P. infestans. A 1976 study by Dr. Gene Easton (WSU-IAREC) monitored RH beneath the plant canopy of center pivot cultured 'Russet Burbank' potatoes. RH > 90% for a sufficient infection period (10 hrs) was common. He concluded that heavy irrigation augmented by August rains and dense foliage "created an ecoclimate favorable for blight" which did develop. In one circle, stopping irrigation for 10 days arrested further infection.

Subsequent late blight "epidemics" have developed under similar environmental conditions (Table 1). Thus, if subnormal day temperatures occur, coupled with normal cool desert nights and the free moisture available under sprinkler irrigation, central Washington can have "ideal conditions" for late blight. Excessive irrigation should be avoided, especially during cloudy or rainy periods.

One final factor, fungal inoculum, must be present for disease. P. infestans cannot survive when separated from living host tissue. The fungus overwinters in diseased tubers, including those left in the soil, undestroyed in cull piles, or intended for use as seed pieces the next season. New emerging sprouts are rarely infected. Usually the foliage is infected from spores produced on tubers at or near the soil surface. Similarly infected volunteers and rotting cull piles can also contaminate newly emerged fields. The fungus generally will not survive winter freezing of infected tubers.

Infected potato plants develop brownish, purplish, or blackish spots, streaks or blotches on the leaves and stems. Leaf lesions may be variable in size and shape depending upon environmental conditions and cultivar. Lesions are often found on upper leaves and stems. During humid periods, a whitish, downy, "mildew" may develop on the leaf underside. This is the sporulating fungus. When scouting a circle, check the plants near the pivot and any other area where moisture remains on the vines the longest.

Overhead irrigation also impacts the potential for tuber infection during the growing season. Spores formed on the foliage can be washed into the soil and infect the shallower tubers if vines are not well "hilled". Irrigation should be decreased as vines die and stopped at least two weeks preharvest. Healthy tubers can become infected at harvest if infected green vines are still present. Total vine death at harvest is a must for tubers headed for long term storage.

Tubers from suspect fields should be closely monitored for symptoms in storage as the disease can spread to adjacent healthy tubers in the shed. Infected tubers develop brown to metallic purple sunken areas. A tannish-brown granular dry rot extends 1/8 to 1/4 in. into the tuber. The boundary between healthy and diseased tissue is irregularly defined and peg-like projections may penetrate into the healthy area. The rotted area is usually firm unless secondary soft rotting bacteria are present.

To summarize cultural control measures:

* use certified disease-free seed stock
* destroy cull piles
* control volunteers, especially after a mild winter
* adequately hill tubers
* kill vines 2 weeks preharvest and reduce irrigation
* avoid harvest under wet conditions
* remove infected tubers prior to storage
* avoid free moisture in storage

Chemical control measures should be carefully considered. Protective fungicides may be of benefit if a healthy field is threatened by an adjacent diseased field. This is more effective for crops under rill irrigation than center pivot as subsequent sprinkler irrigations will decrease coverage.

Systemic fungicides containing metalaxyl, which inhibits spore germination, are registered. Since P. infestans has developed resistance to metalaxyl, current formulations contain a protectant such as mancozeb (Ridomil MZ58) or Bravo (Ridomil Bravo 81W). Note that these products have plantback restrictions. Both currently require a twelve month interval before planting wheat, barley and corn.

Metalaxyl-resistant strains of the late blight fungus were confirmed in 1991 from the Columbia Basin. Resistant strains also have been found (1990, 1991) in western Washington and British Columbia. Current suggested guidelines for managing metalaxyl-resistant late blight in central Washington have been developed. These are discussed elsewhere in these proceedings and were recently published in SPUD TOPICS, VOLUME 37(3): August 13, 1991.

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Table 1. History of late blight in central Washington

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| 1947 | FIRST REPORTED EPIDEMIC | CLOUDY, RAINY WEATHER |
| 1956 | -- | 1ST CENTER PIVOT SYSTEM |
| 1965 | -- | FEWER THAN 10 CENTER PIVOT SYSTEMS |
| 1974 | REPORTED IN STORAGE | MILD WINTER |
| 1975 | EPIDEMIC | INOCULUM FROM SEED IN 1973, 1974 |
| 1976 | TRACE | -- |
| 1977 | TRACE | -- |
| 1982 | EPIDEMIC | MILD WINTER, RAINY AUGUST |
| 1990 | EPIDEMIC | MILD WINTER, RAINY AUGUST |
| 1991 | EPIDEMIC | COLD WINTER, COOL, WET JUNE |