

Fungicides Protect Potatoes Worldwide from a Disease that Caused the Deaths of Millions of People

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The pathogen *Phytophthora infestans* causes a disease known as “late blight” which is misleading because while late blight can develop late in the season, it can also develop early or midseason.

Following infection, the pathogen grows within plant tissues, breaking down cell walls so that it can use the nutrients found within them. Severely affected plants have an acrid odor which is the result of dying potato tissue. The disease spreads rapidly. All the plants in a field may be killed in a few days [1]. On a tuber, the disease spreads irregularly from the surface through the flesh like the diffusion of a brown stain. An effect of the disease is the wet rot phase, which is due to the invasion of secondary bacteria following late blight development. This phase causes a very wet, soft, or slimy and foul smelling rot [2].

Late blight was first reported in the U.S. in Philadelphia in 1843, and subsequently spread throughout the country [3]. Late blight was reported in Europe in 1845 where it had spread to Belgium, England, and Ireland. Irish peasants subsisted almost entirely on potatoes. 40% of the Irish potato crop was destroyed by late blight in 1845 and almost 100% destruction occurred in 1846 [4]. An estimated 1.5 million Irish died of famine and disease during the late blight epidemic, and a similar number of people emigrated, mainly to North America [5].

In 1845 and 1846, late blight caused potato harvest failures in Austria, Belgium, Denmark, France, Germany, Sweden, Switzerland and The Netherlands. Due to rust, grain harvests were also poor in those years. The epidemics of late blight together with reduced grain production resulted in a loss of lives estimated at 700,000 [6].

Late blight continued to be a devastating disease until the 1880s when copper fungicides were discovered and widely adopted in Europe. During World War I, all of the copper in Germany was used for shell casings and electric wire. None could be spared for making copper sulfate to spray potatoes [7]. A severe late blight outbreak in Germany's potatoes in 1916 went untreated and the potatoes rotted in the fields. The resulting scarcity of potatoes led to the deaths of 700,000 German civilians from starvation [7]. Today, fungicide use on potatoes represents \$700 million in annual sales which is about 7 % of total crop fungicide sales. Potato yields vary around the world in large part due to the intensity of fungicide spraying for late blight.



Late blight infection in potato field



Late blight lesions consist of brown, granular, rotted tissue



Gleaning potato fields during the Irish potato famine

References

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