



## Epidemiology of Disease in Plant Pathology

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### DESCRIPTION

Since the first farmers started growing crops, people have been interested in reducing crop losses due to plant diseases. Developments in crop production technology over the past 10,000 years have woven the principles of plant disease management into the fabric of our civilization. The decisions about when, where and what to plant and the development of specific cultural practices were based on countless trials and errors. Undoubtedly, successful agricultural practices depended on suppressing plant pathogen outbreaks, even if farmers had no particular awareness of the underlying biological mechanisms that led to their success. Around the world, our attempts to prevent plant diseases have directly or indirectly determined what we eat and where we settle. We present a mathematical model of plant disease prevalence. Examples in the published literature demonstrate how these models can be used to make business decisions.

Epidemiology is the science of how diseases arise in populations, in these context plant populations. It is a sub discipline within plant pathology that deals with the study of temporal and spatial changes that occur during epidemics caused by pathogen populations in plant populations. Epidemiology has evolved and matured since the mid-20<sup>th</sup> century and has influenced the development of general plant pathology. An early phenomenological focus was on temporal disease progression curves, the dynamic patterns of how epidemics develop, and how these can be used to compare epidemics qualitatively and quantitatively. Techniques for quantifying disease progression have been established and will be further developed over the next 30 years. Much of the research during this period was directed to

the prevalence of foliar fungal pathogens. Next, we discuss plant virus epidemics, linking spatial and temporal aspects in the overall assessment of epidemic progress, disease management practices, soil-borne diseases, biological control, crop losses, and disease resistance and mixed. Many other aspects of the method were explored, including the disease population. Consistently, the broader aspects of global food production and access to food have been major epidemiological concerns with profound ecological underpinnings to which plant disease-epidemiology has made important contributions. In addition, epidemiology deals with diseases affecting non-food crops, forage, forestry, grasslands and related native plant communities, for which an ecological perspective is essential. This bibliography consciously attempts to cover a wide range of research areas typical of the multidisciplinary nature of epidemiology. It provides an overview of the current state of plant disease and epidemiology, with a particular focus on original research published since the early 21<sup>st</sup> century that demonstrates recent developments in the field.

Plant disease epidemiology, as a subfield of plant pathology, deals with factors that cause plant diseases. The link between theoretical or experimental epidemiology and the management of plant diseases in the field is therefore logical. A large body of literature demonstrates that epidemiology plays a descriptive and predictive role, identifying and quantifying factors that lead to disease development or cause spatial or temporal increases in disease intensity. However, as several authors point out, the impact of epidemiology on disease management is not always clear, highlighting the need for a better understanding of the links between theory and experimentation and practice. We have highlighted in this chapter several case studies with clear links between epidemiology and disease management.

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