

Simulation Modeling in Botanical Epidemiology and Crop Loss Analysis

Serge Savary and Laetitia Willocquet

INRA, UMR 1248 AGIR, 24 Chemin de Borderouge - Auzeville, CS 52627, F-31326

Castanet-Tolosan cedex, France

Université de Toulouse, INPT, F-31029 Toulouse, France

Foreword

Over the years, modeling has become an integral part of plant disease epidemiology (or botanical epidemiology). As in other fields of research, modeling in plant disease epidemiology may serve very different purposes, including:

- synthesizing available data on epidemiological processes;
- predicting epidemiological patterns;
- developing a conceptual framework that captures available data;
- organizing epidemiological knowledge to identify knowledge gaps; or
- designing experiments aimed at testing a theory.

The number of modeling approaches used in plant disease epidemiology has been increasing at a very fast rate. It is not the purpose of this module to review all possible approaches.

This module was developed to highlight, illustrate, and implement the linkages between models and data. Models are necessary to achieve one or several of the objectives listed above using the available data, and data are necessary to both develop and assess models.

Yet, as plant disease epidemiology expands as a field of research, there seems to have been an increasing disconnect between 'field epidemiologists' who collect data and 'epidemiological modelers' who develop models. This gap needs to be filled, because data collection needs to be based on a good understanding of the modeling objective(s) and approach(es), and because model development requires a good understanding of field realities.

The objective of this module is therefore to bridge the gap between 'observers' and 'modelers'. Among the wide array of possible approaches, we chose one which is particularly visual, involves as little calculus as possible – and thus enables one to concentrate on concepts, and allows the sharing of working examples. We therefore chose the mechanistic simulation approach as a vehicle to address the dynamics of plant disease epidemics and their impact on crop yield.

Serge Savary

Laetitia Willocquet

June 2011, International Rice Research Institute, Philippines

November 2012, Institut National de la Recherche Agronomique, France