

Zoe Lawrence: The spatiotemporal dynamics of African Cassava Mosaic Disease

Abstract:

African Cassava Mosaic Disease, a vector-borne plant disease, causes massive food shortages throughout sub-Saharan Africa. A system of ordinary differential equations is used to find the equilibrium values of the whitefly vector and the cassava plants it affects. The temporal ODE system is modified to incorporate the spatial dynamic. The resulting system of advection-diffusion equations is analyzed using finite differencing in MATLAB to assess the spatiotemporal spread of ACMD.

The partial differential equations system is systematically altered and solutions are assessed in terms of the relative cassava yield they predict. Simulations include parameter sensitivity analysis, spatial modifications, analysis of the impact of a source term, and initial condition variance. Results are compared with field data. Practical implications of these simulations for controlling ACMD are explored. Data suggests that the use of windbreaks and ACMD resistant strains of cassava will have the most beneficial impact on cassava yield.