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Abstract

Modelling Biocontrol Agents as Plant Protection Tools †

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Abstract: In recent years, researchers have increasingly explored sustainable tools for plant protection against pathogens, including the use of biological control agents (BCAs), which have the potential to complement or replace chemical fungicides. However, global reliance on their use remains relatively insignificant and the factors influencing their efficacy remain unclear. The complex interactions among a target pathogen, a host plant, and the BCA population in a changing environment can be studied by process-based, weather-driven mathematical models, able to interpret the combined effects on BCA efficacy of: (i) BCA mechanism of action, (ii) timing of BCA application with respect to timing of pathogen infection (preventative vs. curative), (iii) temperature and moisture requirements for both pathogen and BCA growth, and (iv) BCA survival capability. When the model was used under three contrasting weather conditions for the control of Botrytis bunch rot in grapevine, BCA efficacy was mostly influenced by environmental conditions, accounting for > 90% of the variance in simulated biocontrol efficacy. These findings indicate that the environmental responses of BCAs should be considered during their selection, BCA survival capability should be considered during both selection and formulation, and weather conditions and forecasts should be considered at the time of BCA application in the field. Different commercial BCAs for the control of *Botrytis cinerea* showed different environmental requirements and adaptation capabilities; therefore, the most suitable BCA to be used for a specific field application may consider weather conditions and forecasts at the time of intervention.

Keywords: integrated pest management; biological control; epidemiological model; weather conditions

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