Host mixtures for plant disease control: benefits from pathogen selection and immune priming

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Multiline and cultivar mixtures are highly effective methods for agroecological plant disease control. Priming-induced cross protection, occurring when plants are challenged by avirulent pathogen genotypes, and resulting in increased resistance to subsequent infection by virulent ones, is one critical key to their lasting performance against polymorphic pathogen populations. Strikingly, this mechanism was until recently absent from mathematical models aiming at designing optimal host mixtures. We developed an epidemiological model to explore the effect of host mixtures composed of variable numbers of single-resistance cultivars on the equilibrium prevalence of the disease caused by pathogen populations polymorphic for virulence complexity. This model shows that a relatively large amount of resistance genes must be deployed to achieve low disease prevalence, as pathogen competition in mixtures tends to select for intermediate virulence complexity. By contrast, priming significantly reduces the number of plant genotypes needed to drop disease prevalence below an acceptable threshold. Given the limited availability of resistance genes in cultivars, this mechanism of plant immunity would make the use of host mixtures more achievable in practice.

Références

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