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The proportion of resistant hosts in mixtures should be biased towards the resistance with the lowest breaking cost

Current agricultural practices facilitate emergence and spread of plant diseases through the wide use of monocultures. Host mixtures are a promising alternative for sustainable plant disease control. Their effectiveness can be partly explained by priming-induced cross-protection among plants. Priming occurs when plants are challenged with non-infective pathogen genotypes, resulting in increased resistance to subsequent infections by infective pathogen genotypes. We developed an epidemiological model to explore how mixing two distinct resistant varieties can reduce disease prevalence. We considered a pathogen population composed of three genotypes infecting either one or both varieties. We found that host mixtures should not contain an equal proportion of resistant plants, but a biased ratio (80 : 20) to minimize disease prevalence. Counter-intuitively, the optimal ratio of resistant varieties should be biased against the costliest resistance for the pathogen to break. This benefit is amplified by priming. This strategy also prevents the invasion of pathogens breaking all resistances.

This is joint work with Pauline Clin, Frédéric Grognard, Didier Andrivon, and Ludovic Mailleret.