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**Marta Zaffaroni[1,3], Loup Rimbaud[2], Julien Papaïx[3], Jean-François Rey[3], Laurent Delière[1], Anne-Sophie Miclot[1], Adeline Alonso Ugaglia[1] and Frédéric Fabre[1,*]**

[1]*INRAE, Bordeaux Sciences Agro, SAVE, 33882 Villenave d'Ornon, France*

[2]*INRAE, Pathologie Végétale, 84140 Montfavet, France*

[3]*INRAE, BioSP, 84914 Avignon, France*

[*]*presenting and corresponding author : frederic.fabre@inrae.fr*

**Abstract:** Downy mildew represents a real threat for grapevines in all vine-growing areas of the world, leading to significant yield losses and massive recourse of fungicides. Over the past years, breeders have been engaged in breeding programs for resistance to grapevine downy mildew, resulting in the creation of several resistant varieties. At present, growers can plant monogenic (mainly with the resistance factors Rpv1, Rpv3 but also Rpv10 and Rpv12) or pyramided cultivars (mainly cumulating Rpv1 and Rpv3). Currently, the resistance factors Rpv1 and Rpv3 start to be deployed in France. These two resistance factors can be deployed in: (i) monogenic cultivars sown in the same field (mixture strategy), (ii) monogenic cultivars sown in different fields (mosaic strategy), (iii) pyramided cultivars (pyramid strategy) and (iv) in hybrid strategies that combine the three previous basic strategies. Here, we will first introduce the spatially explicit stochastic model *landsepi*, as modified and parameterised to simulate the life cycle of grapevine downy mildew. The model (available in the R package *landsepi*) simulates the evolution of a plant pathogen in an agricultural landscape, following the deployment of resistant cultivars. It has been used to investigate the outcomes of the four deployment strategies listed above. More specifically, these strategies were compared using four different criteria: (i) the epidemiological control (disease severity over the whole landscape), (ii) the evolutionary control (time point at which the generalist pathogen adapted to the pyramided cultivar get established), (iii) an environmental outcome (number of fungicide treatments applied) and (iv) an economic outcome (cumulative net profit). Results particularly highlight the risks of resistance breakdown associated to the coexistence of monogenic and pyramided cultivars in the same landscape. Finally, we will illustrate how *landsepi* has been used as a tool to co-design deployment scenarios and discuss their outcomes with the staff of a cooperative cellar growing nearly 2000 ha of grapevine in South-western France.

**Key words**: durable resistance, landscape epidemiology, major gene resistance, participatory approach, simulation modelling.