New resistance-genes deployment strategies as non chemical alternatives for the durable management of root-knot nematodes in vegetable crops rotation

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The current restrictions on the use of chemical nematicides have contributed to increase root-knot nematode problems in horticultural crops. In this context, plant resistance appears as the most effective method of control, but the possible occurrence of virulent nematodes able to reproduce on *R*-plants may constitute a severe threat to this control strategy. To implement a rational management of *R*-lines increasing the durability of the *R*-genes, we tested several *R*-gene deployment strategies. Experiments were conducted in climate-controlled rooms, in greenhouses, and under 3-years-field agronomic conditions comparing the succession of the same *R*-genes every year, when introgressed in a partially resistant vs. a susceptible genetic background, the alternance, the mixt cultivation and the pyramiding of two *R*-genes with different modes of action in ~~one~~ a single genotype. At the plant level, we previously showed that i) the choice of the *R*-genes and the genetic backgrounds in which they are introgressed can lower the frequency of resistance breakdown, and ii) the pyramiding of two different *R*-genes in one genotype totally suppressed the emergence of virulent isolates. Here, at the field and rotation level, we confirmed these results and showed that i/ alternating different *R*-genes in rotation was efficient to reduce the selection pressure of *R*-genes on the pathogens and allowed to recycle ineffective *R*-genes, and ii) optimal cultivation practices of *R*-plants increase their "trap" effect and may decrease the amount of pathogens in the soil, below their damage threshold. These results are in good agreement with concepts recently developed from the analysis of other plant-pathogen interactions. The root-knot nematode model could thus contribute to generalize strategies for the breeding and management of *R*-cultivars strengthening and increasing the durability of qualitative resistances.

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