Experimental evidence of the efficiency of two resistance genes deployment strategies - pyramiding or alternating - for sustainable management of root-knot nematodes

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Scientific Programme and Abstracts

Sessions

Session 1: Impact of plant disease resistance on the structure and evolution of pathogen populations

Session 2: Sustainable and integrated breeding and deployment of genetic resistance

Session 3: From plant-pathogen molecular interactions to the durability of resistance

Session 4: Socio-economic issues related to the use of resistant varieties and their deployment in agro-systems

Invited Speakers

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Abstract

The current restrictions of the use of chemical nematicides have contributed to increase root-knot nematode (RKN) problems in horticultural crops. In this context, plant resistance appears as the most effective and sustainable method of control. In horticultural crops, a few major resistance (*R*) genes are available, but the possible occurrence of virulent nematode populations able to reproduce on *R*-plants may constitute a severe threat to this control strategy. Here, we tested several *R*-gene deployment strategies in the pepper-nematode interaction to implement a rational management of the *R*-cultivars increasing the sustainable management of RKN. Experiments were conducted in climate-controlled rooms, in greenhouses, and under 3-years-field agronomic conditions comparing i) the succession of the same *R*-gene every year, when introgressed in a resistant vs. a susceptible genetic background, ii) the alternance of single *R*-genes in rotation, iii) the mixture of genotypes bearing single *R*-genes sown in the same plot, and iv) the pyramiding of two *R*-genes in one genotype. Results allow the identification of conditions lowering the emergence of virulent nematodes and assess the time required for the sustainable improvement of soil health (reduction of parasite populations under their damage threshold) using the *R*-plants as RKN "traps". Alternating different *R*-genes in rotation was confirmed to be efficient to decrease virulent populations in fields due to the specificity of the virulence previously demonstrated in laboratory experiments. Suppression of the emergence of virulent isolates because of the pyramiding of two different *R*-genes in one pepper genotype was confirmed in controlled and natural conditions and proved durable during a 3-years-field experiment. Recently, a new project called 'GEDUNEM' has been launched in the framework of the INRA metaprogramme SMaCH (Sustainable Management of Crop Health). It aims at identifying innovative strategies across the agrosystem, combining varietal resistances in crop rotations with agronomic practices, for the sustainable and integrated management of RKN in protected vegetable cropping systems.

Keywords: sustainable crop protection, breeding strategy, resistance gene deployment, virulence emergence, root knot nematodes, *Meloidogyne spp.*, *Capsicum spp.*