Year of CfP: 2009

Project No 0902-011

Project title: A tool to conceive sustainable production systems - case of the peachbrown rot couple (PRIMo)

Unit managing the project: GAFL, Genetic Improvement of Fruits and Vegetables [INRA]

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Sub-thematic axes: IPB-1 (Integrative Plant Biology 1: *Genetics and genomics, plant breeding, ecophysiology*), IPB-2 (Integrative Plant Biology 2: *Plant pests and diseases, integrated crop protection, population ecology*)

Objectives:

Monilinia laxa causes brown rot in peach fruits and can provoke as much as 30 to 40% of crop losses. No other alternative than chemical treatment is available so fungicide applications are generalized and occur till pre-harvest. *M. laxa* conidial infection has been described occurring through wounds only, so cuticular cracks are likely to play a major role for fungal infection. Consequently, the probability of infection of a fruit depends on both inoculums density and cuticular cracks surface.

The cuticular crack density was shown to mainly vary with the intensity of the fruit growth, itself varying with the fruit crop load and irrigation regimes. Cuticular cracks can represent more than 10% of the fruit surface area. These cracks are not only large opportunities for fungal infection, but also contribute to fruit transpiratory losses that influence fruit growth and quality build-up. Sensitivity of cuticle to cracks may be controlled by the genome.

Practices can modulate infection probability, at the inoculum level as well as at the fruit level. Irrigation regimes and fruit thinning largely influence fruit growth and cracks appearance. Moreover, irrigation increases humidity that may favor fungus sporulation and germination. The peach-brown rot couple is thus a complex system under the triple influence of the genotype (fungus and host), the environment and cultural practices. Studying this system could lead to a reduction of fungicide use and thus to ecological, economical and health benefits. An integrated approach via modelling appears to be the best way to handle this complex system and propose a tool for decision making.

The aim of this project is to build a tool to conceive innovative management strategies that optimize genotype x environment x practices interactions to limit peach fruit contamination by brown rot in the orchard. For this, an existing process-based model (virtual fruit) describing growth and quality elaboration of peach fruits will be improved. The improved model will be used to conceive and evaluate production systems combining innovative practices and cultivars according to their cuticular and qualitative characteristics. This will be realised using efficient multiobjective optimisation algorithms and reliable evaluation methods. The genotype x environment x practices interactions will be optimized and the production systems proposed will be evaluated according to various criteria: feasibility (working time), economic profitability (yield, fruit size, turnover), environmental impact (number of pesticides, period relative to harvest, water consumption) and production quality (gustative and conservation potential).

Total Agropolis Fondation funding: €99,254 (salary for a post-doctoral fellow, travel expenses, computers)

Funding category(ies): Agropolis Fondation post-doctoral fellowship

Project duration: 01 January 2010 - 31 march 2012

Keywords: peach – fungi – brown rot – *Monilinia laxa* – modelling – genotype – practices – optimisation.