Participative design and assessment of innovative low-input grapevine cropping systems

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Since 2012, with the support of the PURE Project, three innovative experimental platforms were built in France to test low-input grapevine cropping systems (located in Angers, Bordeaux, and Montpellier). The objectives were to reach a high reduction of pesticide use (over 50%) and to promote the alternative IPM and biocontrol methods without any decrease in yield and quality. Innovative cropping systems are needed in viticulture to achieve these goals. After a first step of prototyping of these new cropping systems, experimentations were carried out to assess the performances of the prototypes.

We make the hypothesis that innovation for pest and disease management in perennial crops comes from combination of practices and their interactions. Expert groups designed the prototypes. They built the set of objectives and constraints (SOC) to be satisfied by the prototypes. These grapevine cropping system prototypes were then assessed on the three platforms developed during the PURE project.

A DEXiPM Grapevine model was adapted in PURE project for the overall assessment of the sustainability of the tested farming systems. The testing of cropping systems was radically different from classical factorial trials that test the effect of a modality in agronomy. To evaluate the system performance, experimental plots must be independent agroecosystems and be fairly large (over 2,000 m²). The homogeneity of the physical environment, soil and climate is important. With repetitions, these tests mobilize significant investments over several years in the case of perennial crops.

Cropping system trials experiment a set of decision rules designed for the management of crop practices. If the objectives of the SOC are not achieved, prototypes can be re-adjusted before validation and dissemination. Three main ways of pesticide reduction are explored: (i) IPM, (ii) alternative products and biocontrol, (iii) zero-pesticide cropping systems based on new grapevine mildew resistant varieties. Seven prototypes are tested in INRA experimental farms in Angers (Loire Valley, center of France), Bordeaux (atlantic region), and Montpellier (Mediterranean region).

The first results in 2012 showed that 50% of the treatment frequency index (TFI) was obtained in over 40% of the tested prototypes. This reduction in pesticide use results primarily from improved control strategies and control of the application of plant protection. The first DEXiPM Grapevine assessments show the high environmental performance of innovative biocontrol strategies. However, the IMP strategies have the best overall sustainability for the moment with better economic and social assessment. Pesticide efficiency and substitution allow the first steps of progress in the systemic approach carried out. The re-design of the grapevine system will be necessary in order to reduce pesticide use despite the high sensivity of grapevine to pests and diseases.