

Context

The profitability of deciduous fruit orchards in semi-arid zones, especially in southern and eastern Mediterranean countries, depends on the availability of irrigation water throughout the growing season. Studies of water stress effects on growth have been mostly conducted on annuals, focusing on crop management and the physiological and molecular mechanisms underpinning water use efficiency. Unlike annuals, whose life cycle only depends on current conditions without investment in perennial structures, fruit tree development in any year strongly depends on the environmental conditions in the preceding years. Still unanswered is the scientific question of how the fruit tree uses water to grow, flower, fruit and at the same time develop buds for the next season. Also, there is a crucial need for irrigation protocols to manage severe and/or temporal reductions in water availability, keeping in mind that water management techniques not only modify growing and fruiting patterns, but also pest dynamics. The drive towards sustainable agriculture by reduced inputs, especially of chemicals, strengthens the idea that pest infestation has to be considered within water management strategies. Our project aims to contribute to develop sustainable fruit production in a context of increasing ecological and climatic stresses.

Objectives

APMed is centred on two high added-value fruits grown in most Mediterranean countries, apple and peach, to gain knowledge on how fruit trees adapt to water scarcity and what are efficient means to improve fruit production in these contexts, including the possible reduction of aphid infestations. We share the opinion that growing fruit trees in dry zones cannot be solved by disconnected disciplines, thus we mobilise different research competences to address scientific and applied aspects. First, we characterise ecophysiological mechanisms [at leaf and stem levels] underlying resistance or tolerance to drought, aiming to improve breeding and selection schemes for drought-tolerant cultivars and rootstocks that maintain

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commercial productivity at a lower water use. Second, we assess several horticultural practices to optimise water use in orchards: tree training to optimise leaf-fruit ratio; coloured hail-nets to combine crop protection with control of tree vigour and water saving capacity; irrigation scheduling strategies building on Regulated Deficit Irrigation (RDI) concepts to avoid excessive water percolation below the root zone and losses to the atmosphere by surface evaporation. These latter concepts have been developed by members of this consortium. A third aspect focuses on the relationships between plant development and aphid infestations. Indeed, plant development is altered by both water stress and aphids, but reciprocally aphid infestation is altered by plant development, leading to non-linear responses of aphid infestations to tree water status and consequently to irrigation management.

Workplan

APMed activities spans five Work Packages bringing together five countries: France as coordinator, Israel, Italy, Morocco and Spain. Seven research teams are involved with complementary competences in irrigation scheduling in deciduous fruit tree orchards (Israel, Morocco, Spain), fruit tree ecophysiology (France, Italy), and pest infestation (France, Morocco). Furthermore, growers and researchers collaborate through already established networks in all countries, which includes experimental centres and extension services.

