Integrated management of Verticillium wilt in olive

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Verticillium wilts are amongst the most devastating diseases in agricultural production worldwide. Collectively, these diseases cannot be effectively controlled by applying a single control measure, but rather are best managed by an integrated disease management (IDM) strategy. Integrated disease management strategies and minimum use of chemicals will be enforced in the EU member countries by year 2014, according to Directive 2009/128/CE of the European Parliament and the Council of 11/24/2009. However, IDM is not a panacea for the control of plant diseases. It is an ecology-based approach aiming minimizing damage caused by diseases through the combined use of all available disease control measures, either simultaneously or in a sequence, through actions taken prior and after establishing the crop. The integrated management of Verticillium wilt diseases is difficult because complexities of the management strategy itself are overlaid on the inherent complexities of target pathosystems. Verticillium wilt of olive caused by *Verticillium dahliae*, the most important soilborne disease of olive worldwide, is an example of such complexities. Control of this disease is made difficult by: (i) the long survival of the pathogen in soil; (ii) its ability to infect hundreds of plants confined within the xylem during its parasitic phase; (iii) the genetic and virulence diversity of *V. dahliae* populations, including a highly virulent, defolianting (D) pathotype; and (iv) the easy spread of the pathogen within and among orchards by means of: (a) infected planting material; (b) infested soil; (c) infected debris from cultivated and alternative hosts; (d) irrigation water; and (e) leaves fallen from trees infected with the D pathotype. An IDM strategy for the management of Verticillium wilt in olive that combines the use of pre-planting and post-planting control measures includes: (i) site selection to avoid planting into high risk soils; (ii) use of *V. dahliae*-free planting material; (iii) reduction or elimination of *V. dahliae* inoculum in soil; (iv) protection of healthy planting material from infection by residual or incoming inoculum; (v) use of resistant cultivars and rootstocks; (vi) cultural practices; (vii) soil solarization; and (viii) organic or biological amendments. The efficiency of those control measures may be compromised in olive-growing areas where the D pathotype prevails (such as at southern Spain and the Aegean coastal region in Turkey) because: (i) the lowered threshold inoculum density (ID) for disease by D isolates compared with that by ND; (ii) the role of leaves fallen from infected trees as a source of inoculum for secondary infections; and (iii) the increased susceptibility of olive cultivars to infections by D *V. dahliae* and the lessened ability to recover from them. The recovery phenomenon is an intriguing feature of olive wilt whereby the plant is able to recover from disease over time, thus determining that new infections through the root system are needed for disease to develop in a tree on successive years. The recovery phenomenon should facilitate an integrated management of the disease aimed at reducing the potential for severe disease in young trees and protecting the root system of recovered trees from new infections. The practice of IDM of Verticillium wilt in olive requires involvement of well-trained professional plant pathologists able to implement the tenets of that concept at the local level, as well as to incorporate into decision-making frameworks new knowledge and technologies that may be developed from scientific research. This requirement might be at risk as institutional support has been reduced through declining or even despairing University education in Plant Pathology.

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