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Do perennial alleys help to maintain arbuscular mycorrhizal communities in temperate agroforestry systems ?

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Arbuscular mycorrhizal (AM) fungi are crucial for plant nutrition and the sustainability of agroforestry systems. However, the contribution of each agroforestry component (i.e. trees, under-tree herbaceous vegetation -UtHV- and crops) in the establishment and maintenance of AM communities is poorly documented particularly in temperate areas. This study investigates the spatio-temporal dynamics of AM fungi colonizing roots of the three agroforestry components in southwest France. Standing fine root length density and production, AM activity (colonization and extraradical hyphal growth) and diversity of walnut trees, UtHV and soft wheat were assessed over one year in two agroforestry systems at different distances from the perennial tree-UtHV alley. Compared to UtHV, trees showed a higher ability to colonize superficial layers far into the cultivated alleys due to their wider root system in summer. However, due to higher root densities and well established AM fungi observed throughout all the year, UtHV appeared to be more ecologically relevant to maintain an active source of AM inoculum for newly developing crop roots in winter. High degree of root proximity and similarity of AM fungal communities among the three agroforestry components provide new perspectives in deciphering the significance of common mycorrhizal networks in plant to plant interactions.

Keywords: metabarcoding, phenology, root length density, root distribution, under-tree herbaceous vegetation.