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Determinants of arbuscular mycorrhizal communities - soil properties or land use?

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Arbuscular mycorrhizal (AM) fungi accompanied terrestrial plants since some 500 million years of their evolution and are now widespread in all continents and virtually all soils of the world. They establish symbiotic interactions with a majority of extant higher plant species including most economically important plants. They are heavily implicated in plant nutrition, plant-soil carbon cycling, and tolerance to environmental stresses. Under field conditions, AM fungi usually form multispecies communities both in the soils and in plant roots, and it is becoming well established that various human interventions like cropping, crop rotation, tillage, and fertilization may all drive changes in the community composition of these fungi and, consequently, in the symbiotic benefits to the plants. Most of current evidence is stemming from individual short and long-term field trials, and the different studies usually employed diverse approaches, limiting the comparability of results across sites. Large scale sampling designs using unified research methods across different soil types and land use systems have hardly been employed so far. However, this would be imperative to allow direct comparisons of the effects of various environmental conditions (soil type, climate) and human land use practices on the indigenous soil-borne symbiotic microbes in general and the AM fungi in particular. To contribute to filling this gap, we conducted molecular profiling of AM communities in more than 150 Swiss agricultural soils, developed on a range of parent materials, covering a wide range of soil properties such as pH value, texture, carbon content and altitude, and including highly productive fields through alpine pastures. This study indicated strong correlations between AM fungal community patterns and features like soil pH and texture, as well as some consistent shifts in fungal communities due to specific aspects of land use like tillage or fertilization. These results thus appear to be of paramount importance for defining broadly valid thresholds in using AM communities as universal soil quality indicators. Expanding the current efforts on a global scale will be discussed.