# Functional identity has a stronger effect than diversity on mycorrhizal symbiosis and productivity of field grown organic tomato

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## Abstract

Beneficial soil biota, and in particular, arbuscular mycorrhizal fungi (AMF) are increasingly being recognized as key elements of organic and low-input agriculture where agrobiodiversity is central to enhanced crop production. However, the role of AMF in diversified organic systems, especially in field crops, is still poorly understood. A 3-year field experiment was carried out in Central Italy to investigate whether organic cropping systems that promote species and genetic diversity are more prone to mycorrhizal symbiosis increasing tomato growth, production and yield quality. Three tomato cultivars with varying genetic diversity were grown following four cover treatments: Indian mustard (*Brassica juncea* L. Czern.), hairy vetch (*Vicia villosa*Roth), a commercial mixture of seven cover crop species (Mix 7) and no-till fallow. Plants were either inoculated or not in nursery, with the two AMF isolates *Funneliformis mosseae* (IMA1) and *Rhizoglomus intraradices* (IMA6) used alone or mixed in a 1:1 volume ratio. On average, Mix 7 produced higher shoot dry matter (5.0 t $ha^{-1}$) than *V. villosa* (3.5 t $ha^{-1}$) or *B. juncea* (2.5 t $ha^{-1}$). Pre-transplant inoculation increased tomato root colonization at flowering and harvest compared to the non inoculated plants (31.8 *vs* 23.6%) and cv. Rio Grande was on average the best colonized. The mean fresh weight of marketable fruits was 18.4, 28.0 and 28.6 t $ha^{-1}$ for cvs. Rio Grande, Roma and Perfect Peel, respectively. Cover crops inconsistently affected tomato marketable fruit production in year 1, while in years 2 and 3, *Vicia villosa* and Mix 7 showed the best effect respectively. In year 3, among the pre-inoculated plants those treated with isolate IMA6 showed a higher production of marketable fruit number $m^{-2}$ (56.7) than those inoculated either with IMA1 (51.5) or the mixed inocula (52.1). Most fruit quality parameters were affected by tomato genotype. This study shows that while increased agrobiodiversity is important to increase agroecosystem resilience, AMF, crop and cover crop functional identity may be more important than diversity *per se* to promote mycorrhizal symbiosis and productivity of field grown organic tomato.

Keywords: Agrobiodiversity; Agroecosystem services; Arbuscular mycorrhizal fungi; Cover crop; Functional biodiversity; Genetic diversity