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Multi-year arbuscular mycorrhizal fungal field application on cereals and pseudocereals: A focus on micronutrients and secondary metabolites

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Production of cereals and pseudo cereals often leads to Fe, Zn and antioxidant deficiency. A better understanding of the potential of field inoculation with arbuscular mycorrhizal fungal (AMF) to increase micronutrient uptake and production of secondary metabolites is needed. We investigated by multi-year field experiments (2013-2017) located in central Italy the role of AMF inoculation in Fe-Zn uptake and biosynthesis of antioxidants in cereals (bread wheat, durum wheat and millet) and in pseudo cereals (buckwheat). The effects of AMF inoculation by *Rhizophagus irregularis*, plant genotypes and several agronomic techniques were investigated. AMF inoculum effectiveness was assessed on concentration of Fe-Zn and antioxidant compounds in grain and transformed products. Occurrence of AMF in roots was assessed using morphological and molecular techniques. In 2014 trial, Fe-Zn grain concentrations were increased by AMF inoculation in durum wheat (53% and 89%) and bread wheat (61% and 90%). Increase in AMF root colonization (durum wheat: 22%; bread wheat: 30%) and modifications in root abundance of AMF sequences, belonging to genera *Rhizophagus* and *Funneliformis* were reported. In 2015, 2016 and 2017 trials, wheat genotypes differently responded to AMF inoculation for Fe-Zn concentrations (Fe: -26% → 113%; Zn: -22% → 98%), for flavonoids (-29% → 196%), for α-lipoic acid (-28% → 199%), for rutin (3% → 27%) and for quercetin (0.9% → 5.2) in whole meal flour and transformed products. In 2016 trial, millet and buck wheat genotypes showed a wide range of variation in AMF root colonization. AMF inoculation represents an agronomic tool to increase food Fe-Zn concentrations and antioxidant compounds.

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