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MOLECULAR AND AGRONOMIC RESPONSES TO PLANT-GROWTH PROMOTING RHIZOBACTERIA (PGPR) AND ARBUSCULAR MYCORRHIZAL (AM) FUNGI IN DURUM WHEAT

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Plant-growth promoting rhizobacteria (PGPR) and arbuscular mycorrhizal (AM) fungi contribute to plant nutrient uptake by increasing the availability of nutrients and the root adsorbing surface (Garg et al., 2006; Asghar et al. 2002). The first objective of this study was to determine the effects of these associations on plant total biomass and grain yield in durum wheat (cv. Anco Marzio). Secondly, we aimed to analyze the root transcriptomic and metabolomic changes in response to mychorrizal infections and the expression pattern of key genes involved in nutrient uptake and stress responses. Field analysis were carried out in inner Sicily, a typical Mediterranean area. Four types of biotic association in presence/absence of easily mineralizable organic nitrogen were studied: 1) not inoculated soil (control); 2) inoculated with a commercial mix of 8 AM fungal species; 3) inoculated with a commercial mix of 13 PGPR (Bacillus spp.); 4) inoculated of both AMF and PGPR mixes. Nitrogen content in aboveground biomass was determined at stem elongation stage. Quantitative RT-PCR assays were designed for nitrogen and phosphate transporter genes basing on sequence homologies with Triticum aestivum. An increase of total biomass when both PGPR and AM fungi were inoculated. In addition, PGPR inoculum determined a biomass increase when the organic fertilizer was supplied. Data showed a general downregulation of the 13 analyzed genes when crop is fertilized. In absence of fertilization, the co-inoculation of PGPR and AM fungi upregulated phosphate transporter genes (PT1, PT2, PT2.1). Mycorrizal inoculation seemed to contribute a greater extent. When organic fertilizer was supplied, similar trend was obserbed only for PT2.1. Transcript abundance of ammonium transporters were higher when crop was co-inoculated with AM fungi and PGPR. In unfertilized conditions, the inoculation of AM fungi significantly induced the expression of the nitrate transporter genes (NRT1.1; NRT2 and NAR2.2) irrespective of the inoculation of PGPR. Mycorrhizal and PGPR inoculation seemed to be synergistically efficient to increase the total durum wheat biomass. Preliminary results of durum wheat transcriptome and metabolome in response to mycorrhizal infections will be additionally presented. Gene expression analysis could lead to the identification of biomarkers usable to early select genotypes for an increased nutrient uptake efficiency.