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Synergistic Effect of Plant Growth Promoting Bacteria and Arbuscular Mycorrhizal Fungi to Enhance Wheat Grain Yield, Biofortification and Soil Health: A Field Study

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Abstract : Plant Growth Promoting Bacteria (PGPB) and Arbuscular Mycorrhizal (AM) Fungi are ubiquitous in soil and often very critical for crop yield and agriculture sustainability, and this has motivated the agricultural practices to support and promote PGPB and AM Fungi in agriculture. PGPB can be involved in a range of processes that affect Nitrogen (N) and Phosphorus (P) transformations in soil and thus influence nutrient availability and uptake to the plants. A field study with two wheat cultivars, HD-3086, and HD-2967 was performed in Malwa region, Bathinda of Punjab, India, to evaluate the effect of native and non-native PGPB alone and in combination with AM fungi as an inoculant on wheat grain yield, nutrient uptake and soil health parameters (dehydrogenase, urease, β-glucosidase). Our results showed that despite an early insignificant increase in shoot length, plants treated with PGPB (Bacillus sp.) and AM Fungi led to a significant increase in shoot growth at maturity, aboveground biomass, nitrogen (45% - 40%) and phosphorus (40% - 34%) content in wheat grains relative to untreated control plants. Similarly, enhanced grain yield and nutrients uptake i.e. copper (27.15% - 36.25%) iron (43% - 53%) and zinc (44% - 47%) was recorded in PGPB and AM Fungi treated plants relative to untreated control. Overall, inoculation with native PGPB alone and in combination with AM Fungi provided benefits to enhance grain yield, wheat biofortification, and improved soil fertility, despite this effect varied depending on different PGPB isolates and wheat cultivars. These field study results provide evidence of the benefits of agricultural practices involving native PGPB and AM Fungi to the plants. These native strains and AM Fungi increased accumulations of copper, iron, and zinc in wheat grains, enhanced grain yield, and soil fertility.

Keywords : AM Fungi, biofortification, PGPB, soil microbial enzymes
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