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Abstract
Application of fertilizers is an essential practice to optimize crop production but it is posing harmful effects in declining the soil fertility and contamination of surface and groundwater, eventually leading to deteriorating the health of agroecosystem. Traces of such chemicals have also been reported to be deposited in agricultural produce that may cause serious health problems in human beings. Considering such facts, organic farming is being promoted worldwide to strengthen agroecosystem, soil health, biodiversity, and biological activities in soil. Use of plant growth promoting bacteria (PGPB) is one of the most important components and are known to enhance nutrient availability, plant growth and yield to maintain sustainable agriculture.
In view of the above, we are focused to promote the use of putative PGPB trains to enhance the nutrient use efficiency and yield of the agricultural crops under organic cultivation. The study exposed that biopriming of amaranth (Amaranthus hypochondriacus) seeds with the selected PGPBs significantly enhanced plant growth ([U+F07E]46%) and yield ([U+F07E]37%) under field conditions. A significant increase (36.18%, 32.45 and 17.11%) in soil nutrients (NPK) and their uptake (68.01%, 104.16 and 116.46%) was recorded in different treatments. Results also showed that the utilization efficiency (EU) of different nutrients (NPK) was increased and ranged between 21.33–102.74 kg/kg in different treatments. Principal component analysis revealed a positive correlation between soil nutrients and their uptake by host plants. The analysis also confirmed the positive correlation between the treatments and nutrient use efficiency. This suggested the potential of selected PGPBs to enhance the nutrient use efficiency by endorsing the conversion of the maximum amount of available nutrients into yield. Similar findings were also recorded in a different study done on strawberry (Fragaria ananassa Duch.) where the application of organic manures and root dip with PGPBs was more effective in maintaining the high levels of NPK in the soil. Further, a significant increase in the nitrogen (2.67%), phosphorous (0.50%) and potassium (1.96 %) content in strawberry leaves was recorded. The application of organic manures and PGPBs also showed higher plant growth and yield than using organic manures alone.
Our studies show that PGPBs can enhance the nutrient use efficiency of the host plant that further contributes to increase the crop yield. In addition, the significant residual amounts of nutrients (NPK) remain available in soil even after harvesting the crop. These residual amounts of nutrients remain available to the next crop and thus can reduce the use of the recommended dose of fertilizer therein. This suggests that PGPBs help in releasing the nutrients sustainably and can contribute towards achieving the goal of sustainable agriculture and soil health.