Siembra
ISSN: 1390-8928
ISSN: 2477-8850
siembra.fag@uce.edu.ec
Universidad Central del Ecuador
Ecuador

Erazo, Norma; Rosero, Gabriela; Álvarez, Pablo
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Siembra, vol. 13, no. 3, Esp., e9594, 2026
Universidad Central del Ecuador
Quito, Ecuador

DOI: https://doi.org/10.29166/siembra.v13i3(Especial).9594

Available in: https://www.redalyc.org/articulo.oa?id=653883476016

SIEMBRA
REVISTA DE CIENCIAS DE LA VIDA

Use of microorganisms in sustainable soil management

Norma Erazo[1,2], Gabriela Rosero[2], Pablo Álvarez[1,3]

Siembra 13 (3) (2026): Special Edition
PROCEEDINGS OF FIRST INTERNACIONAL SYMPOSIUM ON SOIL HEALTH

DOI: 10.29166/siembra.v13i3(Especial).9594

[1] Escuela Superior Politécnica de Chimborazo, Facultad de Recursos Naturales. Riobamba, Ecuador
[2] Escuela Superior Politécnica de Chimborazo, Grupo de Investigación y Desarrollo para el Ambiente y el Cambio Climático. Riobamba, Ecuador
[3] Escuela Superior Politécnica de Chimborazo, Grupo de Estudios Fitoentomológicos. Riobamba, Ecuador

* *Correspondence:* nerazo@espoch.edu.ec

SIEMBRA
https://revistadigital.uce.edu.ec/index.php/SIEMBRA
ISSN-e: 2477-8850
Frequency: half-yearly
vol. 13, issue 3 Special, 2026
siembra.fag@uce.edu.ec

Abstract

Microorganisms, defined as microscopic living organisms, possess a rich enzymatic content that grants them a versatile metabolism, allowing them to adapt to a wide range of ecosystems, including those with extreme conditions. Due to their diverse characteristics, they perform multiple activities, with their role in biogeochemical cycles standing out, giving them a fundamental role in the functioning of the planet. The contribution of microorganisms to environmental health is positive. They are involved in the degradation, transformation, and recycling of organic matter, as well as in its mineralization and nitrogen fixation, phosphorus solubilization (such as PGPR), suppression of soil pathogens, degradation of toxic substances (many from pesticides), production of bioactive compounds, and the induction of systemic resistance in plants, among other functions. These activities align with strategies that can help achieve many of the Sustainable Development Goals [SDGs], such as zero hunger, good health and well-being, clean water and sanitation, affordable clean energy, climate action, life below water, and life on land. However, the contamination of the land by multiple human activities, including the practice of aggressive agriculture, with excessive use of chemically synthesized agricultural inputs, has caused degradation of soil and water, eutrophication of surface and groundwater, accumulation of toxic metals in the soil, affecting beneficial microorganisms. Fortunately, beneficial microbiota, isolated from different types of natural and cultivated systems, selected, scaled and formulated, have potential as microbial inoculants and bioinputs for the improvement of agricultural production and environmental protection, which has opened the possibility of an increasingly growing bioeconomy. Furthermore, if one considers that, in the last 5 years, the prices of agricultural inputs have increased considerably, the use of beneficial microorganisms gains greater importance. Current research has shown that an application with a low dose of chemical synthesis fertilizers in combination with efficient microorganisms and organic matter is similar to the application of a full dose of synthetic inputs, but the combination becomes relevant when it is reflected in the improvement of soil structure, pH, pathogen control, water retention, improvement of crop quality with less application of chemically synthesized pesticides, reasons why, the contribution of microorganisms to health, soil fertility and safety food is huge.

Keywords: Bioinputs, Fertilizers, Beneficial microbiota, Efficient microorganisms.