

Bio-inputs and Ecotechnologies: The Urgent Agenda for Sustainability and Collective Action in Local Territories

Guillermo Aldair Villegas Fuentes^{1*} and María Teresa Magallón Díez²

¹Doctoral Candidate in Administrative Sciences, Metropolitan Autonomous University, Iztapalapa Unit, México

²Professor-Researcher affiliated with the Department of Economics, Metropolitan Autonomous University, Iztapalapa Unit, México

*Corresponding Author

Guillermo Aldair Villegas Fuentes, Doctoral Candidate in Administrative Sciences, Autonomous Metropolitan University, Iztapalapa Unit, México.

Submitted: 2026, Mar 09; **Accepted:** 2026, Apr 03; **Published:** 2026, Apr 15

Citation: Fuentes, V. G. A., Díez, M. T. M. (2026). Bio-inputs and Ecotechnologies: The Urgent Agenda for Sustainability and Collective Action in Local Territories. *Int Nat Sci Int Rese*, 1(1), 01-02.

In a global context marked by the unchecked acceleration of environmental and social crises, solid waste management has become one of the most pressing—and paradoxically least addressed—challenges from an interdisciplinary perspective.

Despite scientific and technological advances, a significant gap persists between available knowledge and its effective implementation in local territories. What prevents existing solutions from truly transforming our environments? The answer compels us to look beyond technical aspects—toward social dynamics, forms of community organization, and public policy frameworks that shape—and often constrain—the adoption of emerging or innovative alternatives.

In this context, biotechnologies applied to solid waste treatment and the use of bio-inputs emerge not only as scientific tools, but also as strategic opportunities to rethink our relationship with the ecosystem—and, above all, to recognize the urgent need to identify, connect, and transform the knowledge that today remains fragmented.

Within this horizon, various biotechnologies—promoted primarily by public universities and leading research centers, at least in the case of Mexico—have begun to position themselves as viable alternatives for the treatment and valorization of solid waste, shifting away from the linear 'use and discard' logic toward circular models.

Processes such as pyrolysis make it possible to transform organic and plastic waste into biofuels, biochar, and other value-added byproducts, significantly reducing the pollutant

load. Complementary techniques such as anaerobic digestion, advanced composting, and vermiculture not only manage waste but also convert it into useful resources for soil regeneration and sustainable agricultural production. Far from being futuristic, these technologies are already available; however, their implementation remains limited.

Moreover, the development and use of bio-inputs represent one of the most promising strategies for transitioning toward more sustainable production models. Biofertilizers, biopesticides, and beneficial microorganisms are transforming the way agriculture is conceived, reducing dependence on chemical inputs and promoting ecosystem health.

Beyond their technical effectiveness, bio-inputs entail a reconfiguration of knowledge: they integrate scientific understanding with traditional practices, opening the door to more inclusive and territorially grounded models of innovation. However, their consolidation faces challenges related to regulation, technology transfer, and—above all—the social appropriation of these alternatives.

Both biotechnologies applied to waste management and bio-inputs share a common structural challenge: their transformative potential depends on the collective capacity to connect science, society, and public policy.

It is not merely a matter of innovating in the laboratory, but of building the conditions that allow these innovations to be understood, adopted, and sustained by communities.

In this regard, the social fabric and community cooperation become central elements for the effective implementation of these solutions, while also requiring institutional frameworks and public policies that acknowledge the complexity of local territories. The

question is no longer whether these alternatives work, but how we can ensure they become common practices in contemporary environmental management.

Copyright: ©2026 Guillermo Aldair Villegas Fuentes, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.