# Application of Organic Fertilizers for Sustainable Agriculture

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## Abstract

The increasing demand for environmentally sustainable agricultural practices has accelerated the development and application of organic fertilizers as alternatives to conventional mineral fertilizers. Organic fertilizers not only supply essential nutrients for plant growth but also improve soil structure, enhance microbial activity, increase organic matter content, and contribute to long-term soil fertility. This review summarizes recent advances in the application of organic fertilizers, with particular emphasis on vermicompost and innovative biocapsulated fertilizer technologies. The paper discusses the classification of organic fertilizers, their agronomic and environmental benefits, and their role in improving nutrient use efficiency while reducing nutrient losses and environmental pollution. Particular attention is given to biodegradable vermicompost-based biocapsulated fertilizers, which enable the controlled release of nutrients and support sustainable nutrient management. A conceptual model of a vermicompost-based biocapsulated fertilizer is presented to illustrate its potential as an environmentally friendly solution for enhancing soil fertility and crop productivity. The findings indicate that integrating organic fertilizers with controlled-release technologies represents a promising strategy for achieving sustainable agriculture and supporting the transition toward circular bioeconomy principles.

## Keywords

Organic fertilizers, sustainable agriculture, vermicompost, soil fertility, nutrient cycling, organic waste.