

About the Department of Zoology

The Department of Zoology, established in 1960, is one of the college's oldest departments, celebrating its Golden Jubilee in 2010 and Diamond Jubilee in 2020. It began with an undergraduate programme and attained Research Department status in 2013. The department is committed to excellence in teaching, research, innovation, and community engagement. Facilities include a Zoological Museum, sericulture units, mulberry garden, and an integrated solid waste management unit, providing hands-on training and experiential learning.

Supported by grants from the University Grants Commission, Department of Biotechnology under the DBT-Star College Scheme, and Department of Science and Technology, the department strengthens research and laboratory infrastructure. It regularly organizes seminars, conferences, workshops, and skill-based training programmes. The UGC-supported Community College Scheme in Sericulture promotes rural women entrepreneurship. Collaborations with OISCA International, Dolphin Special School, and Nature Conservation Foundation foster outreach initiatives. Signature programmes such as "Weekend Deliberation Series" and "Tiny Changes: Tall Impacts" promote knowledge exchange, sustainability, and holistic student development.



CONFERENCE PROCEEDINGS ON SUSTAIN LIFE 2026 : EXPLORING BIOLOGICAL FRONTIERS FOR A GREENER PLANET



SEETHALAKSHMI RAMASWAMI COLLEGE
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CONFERENCE PROCEEDINGS ON SUSTAIN LIFE 2026 : EXPLORING BIOLOGICAL FRONTIERS FOR A GREENER PLANET VOLUME - I

National Conference on SUSTAIN LIFE 2026 : EXPLORING BIOLOGICAL FRONTIERS FOR A GREENER PLANET (EBFGP 2026)

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RESEARCH DEPARTMENT OF ZOOLOGY
2026

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Tamil Nadu, India**

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**CONFERENCE PROCEEDINGS ON SUSTAIN LIFE 2026: EXPLORING
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© Dr. A. S. Maheswari, Dr. J. Viji, Dr. M. Isai

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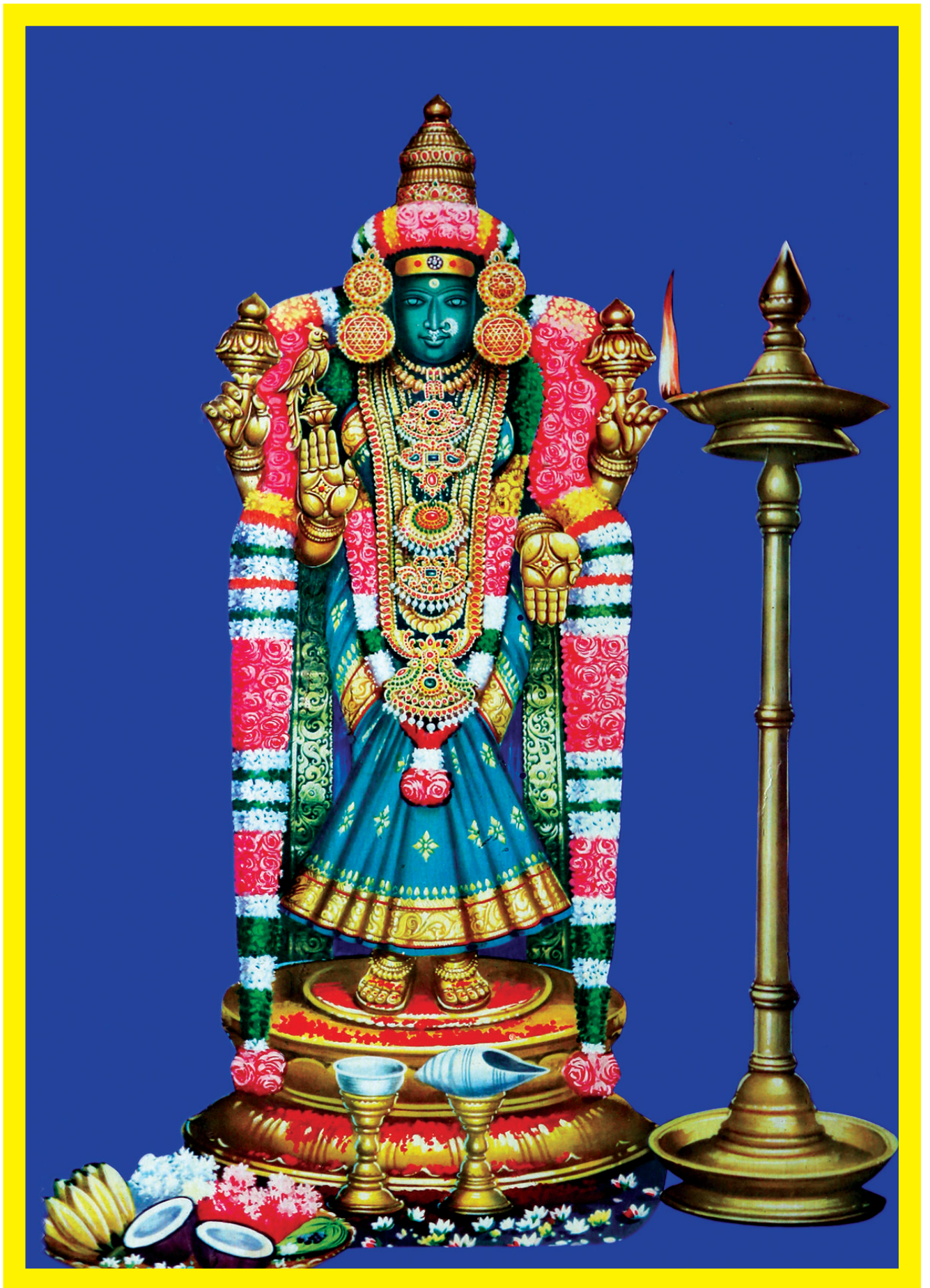


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PREFACE

Dr. M. V. Alli
Principal
Seethalakshmi Ramaswami College,
Tiruchirappalli



It gives me immense pleasure to present the proceedings of the National Conference on **EBFGP 2026**. I extend my warm greetings to all academicians, researchers, industry experts, and students who have contributed to the success of this scholarly gathering.

The conference on Emerging Biological Frontiers for a Greener Planet (EBFGP 2026) serves as a vibrant platform to deliberate upon innovative approaches and sustainable solutions in the field of biological sciences. At a time when the world is facing unprecedented environmental challenges, such academic initiatives play a crucial role in fostering scientific inquiry, collaboration, and responsible innovation.

I sincerely appreciate the dedicated efforts of the organizing committee, faculty members, and student volunteers whose commitment and teamwork made this conference a grand success. My special thanks to the distinguished resource persons and participants who enriched the event with their valuable insights and research contributions.

The papers compiled in this volume reflect contemporary advancements and thoughtful perspectives in areas such as environmental sustainability, biotechnology, ecological restoration, and green innovations. I am confident that this publication will serve as a valuable resource for researchers and inspire further studies in creating a sustainable future.

As we move forward, let us continue to embrace science with responsibility and work collectively towards restoring and preserving our planet. Let this conference be a stepping stone for future collaborations and impactful research endeavors. I congratulate everyone involved and wish the readers an enriching academic experience.

PREFACE

Dr. S. Santhi
Self - Financed Section i/c
Seethalakshmi Ramaswami College,
Tiruchirappalli



"It is with immense delight and a profound sense of appreciation that I pen these words as a message to this magnum opus, a culmination of erudite research papers and thought-provoking deliberations presented at the National Conference on 'Exploring Biological Frontiers for a Greener Planet', meticulously organized by the esteemed Research Department of Zoology.

I am much thrilled to witness the department's unwavering commitment to advancing our understanding of the intricate nexus between biology, ecology, and the environment, and its far-reaching implications for the planet's sustainability. The contributions in this book reflect the collective endeavors of a galaxy of researchers, scientists, and academicians to harness the transformative power of biological sciences in addressing the most pressing environmental challenges of our time.

I applaud the Research Department of Zoology for their indefatigable efforts in promoting interdisciplinary research, fostering synergistic collaborations, and inspiring innovative solutions for a sustainable future.

I do hope that this book will serve as a seminal resource for those seeking to explore the uncharted frontiers of biological research and its applications in creating a greener, more sustainable planet.

I extend my Hearty wishes to the faculty of Research Department of Zoology.

Message by the Convenor

Dr. A. S. Maheswari
Convenor - *EBFGP 2026*
Dean of Quality & IQAC Coordinator
Associate Professor & Head
Research Department of Zoology



It gives me immense pleasure to welcome you all to the Two Days National Conference on “*SUSTAIN LIFE 2026: Exploring Biological Frontiers for a Greener Planet (EBFGP 2026)*” organized by the Research Department of Zoology, Seethalakshmi Ramaswami College, Tiruchirappalli, on 05th and 06th March 2026 in online mode.

As we stand at a critical juncture in addressing global challenges such as climate change, biodiversity loss, food insecurity, and environmental degradation, the role of biological sciences has never been more significant. This conference is envisioned as a vibrant platform to bring together academicians, researchers, industry experts, policymakers, and students to deliberate on innovative biological solutions that promote sustainability and environmental stewardship.

With diverse themes ranging from Synthetic Biology, Environmental Biotechnology, and Bioenergy to Artificial Intelligence in Biological Sciences and Circular Bioeconomy, EBFPG 2026 seeks to foster interdisciplinary dialogue and collaborative research. We believe that meaningful scientific exchange and collective action can pave the way towards a greener and more sustainable planet.

The Research Department of Zoology, with its rich legacy of academic excellence, research contributions, and community engagement, is proud to host this national forum. I am confident that the deliberations and presentations during this conference will inspire innovative ideas, strengthen research networks, and contribute to sustainable development goals.

I extend my heartfelt gratitude to our Management, Principal, Patrons, Organizing Secretaries, and the Organizing Committee for their constant support and dedicated efforts. I warmly welcome all participants and wish you an enriching and intellectually stimulating experience.

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PRODUCTION OF VERMICOMPOST FROM DIFFERENT ANIMAL MANURES

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Abstract

Vermicomposting is an environmentally sustainable biotechnology that utilizes earthworms and associated microorganisms to convert organic residues into stabilized, nutrient-rich organic manure. Animal manures such as sheep, cow, and poultry manure are abundant agricultural by-products with significant nutrient potential but may pose environmental risks if improperly managed. This chapter provides a comprehensive evaluation of vermicompost production using different animal manures, detailing physicochemical transformations, operational parameters, nutrient dynamics, microbiological characteristics, and agronomic performance. Emphasis is placed on thermophilic pre-composting, C/N ratio optimization, pathogen reduction, moisture regulation, and controlled earthworm inoculation. Comparative analysis demonstrates that manure-based vermicompost enhances soil fertility, improves crop productivity, and supports sustainable nutrient cycling systems.

Keywords: Vermicomposting - Animal manure - Sheep manure - Cow manure - Poultry manure - Sustainable agriculture - Organic nutrient management

Introduction

Modern agriculture has witnessed remarkable yield gains through synthetic fertilizers and chemical inputs. However, long-term reliance on these inputs has led to soil degradation, nutrient imbalance, reduced organic carbon levels, and environmental pollution. Consequently, sustainable soil fertility management practices are gaining importance globally. Organic amendments improve structure, microbial biomass, enzymatic activity, and nutrient buffering capacity. Among organic technologies, vermicomposting has emerged as a superior biological process that enhances nutrient mineralization and produces stabilized organic manure enriched with plant growth-promoting

substances. Vermicomposting is a mesophilic bio-oxidative process involving epigeic earthworms, primarily *Eisenia fetida*, working synergistically with microorganisms. Unlike conventional composting, vermicomposting accelerates organic matter stabilization while preserving higher nutrient availability and microbial diversity. Animal manures are among the most widely available organic resources. Sheep, cow, and poultry manures differ significantly in nutrient concentration, organic carbon content, C/N ratio, and decomposition characteristics. Their transformation through vermicomposting not only reduces environmental hazards such as ammonia volatilization, pathogen dissemination, and greenhouse gas emissions but also enhances agronomic efficiency.

This chapter discusses production protocols, physicochemical transformations, nutrient characteristics, and crop responses associated with vermicompost derived from different animal manures.

2 Principles and Mechanisms of Vermicomposting

2.1 Biological Mechanism

Vermicomposting is a biologically driven process in which earthworms actively fragment organic residues into smaller particles, thereby increasing the surface area available for microbial action. As the material passes through the earthworm gut, it undergoes intense microbial colonization, where a diverse community of microorganisms interacts with digestive enzymes to accelerate decomposition. Enzymatic digestion within the gut facilitates the breakdown of complex organic compounds and promotes humification, leading to the formation of stable organic matter. The processed material is subsequently excreted as casts, which are finely structured, stabilized aggregates rich in nutrients and beneficial microbes. Compared to the original substrate, earthworm casts contain higher microbial populations, greater concentrations of available nutrients, and increased levels of humic substances, making vermicompost a superior organic amendment for soil fertility improvement.

2.2 Phases of Vermicomposting

2.2.1 Thermophilic Pre-composting Phase

- Temperature rises to 55–65°C
- Weed seeds destroyed

- Pathogens reduced
- Partial decomposition achieved

2.2.2 Mesophilic Vermicomposting Phase

- Temperature maintained below 30°C
- Earthworms introduced after cooling
- Organic matter converted into granular vermicast

2.3 Critical Operational Parameters

Parameter	Optimum Range
Moisture content	60–70%
Temperature	20–30°C
pH	6.5–7.5
Initial C/N ratio	20–30
Aeration	Moderate

Maintaining these parameters ensures efficient stabilization and earthworm survival.

3 Vermicomposting of Sheep Manure

3.1 Substrate Characteristics

Sheep manure is rich in organic matter and moderately high in nitrogen. It generally possesses a relatively balanced C/N ratio compared to other livestock wastes. However, fresh sheep manure may contain pathogens and requires thermophilic composting for approximately 60 days with turning every 15 days.

3.2 Physicochemical Properties of Sheep-Manure Vermicompost

Typical values include:

- Nitrogen: 0.5–2.9%
- Phosphorus: 0.1–3.36%
- Potassium: 0.15–2.2%
- Organic carbon: 9.5–47%

- C/N ratio: 11–20
- pH: Neutral to slightly alkaline
- The reduced C/N ratio indicates stabilization and maturity of compost.

3.3 Nutrient Dynamics

During the vermicomposting process, significant biochemical transformations occur that enhance nutrient availability and organic matter stability. Nitrogen content often increases as a result of enhanced mineralization of organic compounds and the addition of nitrogen-rich mucus and excretory products secreted by earthworms. At the same time, phosphorus becomes more available through microbial solubilization processes, wherein phosphate-solubilizing microorganisms convert insoluble forms of phosphorus into plant-accessible forms. Additionally, the formation and accumulation of humic substances increase during vermicomposting, reflecting advanced humification and stabilization of organic matter. These humic compounds improve soil structure, nutrient retention, and long-term fertility, thereby enhancing the agronomic value of the final vermicompost product.

3.4 Agronomic Performance

The application of vermicompost in sweet potato cultivation has demonstrated substantial agronomic benefits, including a significant increase in tuber yield compared to conventional nutrient management practices. Enhanced nutrient uptake has been observed due to the improved availability of essential macro- and micronutrients in vermicompost-amended soils. In addition, vermicompost contributes to better soil aggregation by promoting the formation of stable soil aggregates through microbial activity and humic substance development. This improved soil structure enhances porosity and root penetration while simultaneously increasing moisture retention capacity, which is particularly beneficial under water-limited conditions. The slow and gradual release of nutrients from vermicompost ensures a sustained supply of essential elements throughout the growing season, supporting continuous plant growth and improving overall crop productivity.

4 Vermicomposting of Cow Manure

4.1 Substrate Preparation

- Cow manure often has a low C/N ratio (~12). To optimize composting:
- Wheat straw added to raise C/N to ~24
- Thermophilic phase maintained at 65°C for 7 days
- Pathogen elimination achieved
- Compost cooled below 30°C before worm inoculation

4.2 Vermicomposting Duration

- Earthworm inoculation after 15–20 days
- Moisture maintained at 60–70%
- Composting duration: ~90 days

4.3 Chemical Characteristics

- pH: 7.3
- Organic matter: 31%
- Total nitrogen: 33 g kg⁻¹
- Exchangeable potassium: 2800 mg kg⁻¹
- Exchangeable calcium: 3943 mg kg⁻¹
- Salmonella: Absent

4.4 Effect on Cucumber Growth

Experimental studies have consistently demonstrated that the application of vermicompost leads to marked improvements in crop growth and productivity. Plants grown in media amended with 20% vermicompost have attained heights of up to 2.3 m, indicating enhanced vegetative vigor. In addition to increased plant height, significant improvements in leaf chlorophyll content have been observed, reflecting better nitrogen availability and improved photosynthetic efficiency. Fruit yield responses are equally notable, with production reaching up to 9.2 kg per plant under optimized vermicompost treatments. These yield enhancements are closely associated with increased soil enzymatic activity, which accelerates nutrient mineralization and availability. Organic amendments such as vermicompost also stimulate root proliferation, resulting in a more extensive root system capable of efficient nutrient and water uptake, thereby improving overall nutrient use efficiency and crop performance.

5 Vermicomposting of Poultry Manure

5.1 Substrate Characteristics

Poultry manure is nutrient-dense but may contain high ammonia levels and low C/N ratio. Rice hulls are added to achieve a C/N ratio of ~35:1.

5.2 Composting Process

- Moisture: 45–50%
- Initial temperature: ~39°C
- Compost maturity: ~98 days
- Vermicompost ready: ~116 days

5.3 Nutrient Composition

- Nitrogen: 1.5–3.0%
- Phosphorus: 1.0–2.0%
- Potassium: 1.0–1.8%
- Calcium: 2.0–4.0%
- Magnesium: 0.5–1.0%

High nutrient concentration makes poultry vermicompost suitable for high-value vegetable and horticultural crops.

6 Comparative Evaluation of Different Animal Manures

Parameter	Sheep	Cow	Poultry
Nitrogen	Moderate	Moderate–High	High
C/N ratio adjustment	Minimal	Required	Required
Composting time	Moderate	~90 days	Longer
Pathogen risk	Moderate	Moderate	High
Crop suitability	Root crops	Vegetables	Intensive horticulture

Poultry manure provides higher nutrient density, while cow manure offers balanced nutrient supply and easier management.

7 Microbiological and Biochemical Transformations

Vermicomposting significantly improves the biological and biochemical quality of soil by stimulating multiple microbial and enzymatic processes. The application of vermicompost enhances microbial biomass carbon, indicating an increase in active microbial populations responsible for nutrient cycling and organic matter decomposition. It also promotes higher enzyme activities, particularly dehydrogenase and phosphatase, which are essential indicators of soil microbial respiration and phosphorus transformation, respectively. The humification index increases during vermicomposting, reflecting improved stabilization and formation of humic substances that contribute to long-term soil fertility. Furthermore, vermicompost supports enhanced nitrification and phosphorus solubilization processes, thereby increasing the availability of essential nutrients to plants. The diverse microbial community present in the earthworm gut plays a crucial role in accelerating nutrient mineralization, transforming complex organic compounds into readily absorbable forms and thereby improving overall soil productivity and sustainability.

8 Environmental and Sustainability Implications

Vermicomposting plays a vital role in environmental sustainability by efficiently converting livestock waste into a valuable organic resource, thereby reducing the accumulation of untreated manure in agricultural systems. This controlled biological process minimizes the risk of nutrient leaching and significantly lowers the potential for groundwater contamination caused by excess nitrates and pathogens. By promoting aerobic decomposition, vermicomposting also helps mitigate methane emissions that are commonly associated with unmanaged manure storage, contributing to reduced greenhouse gas release. In addition, the application of vermicompost enhances soil carbon sequestration through the stabilization of organic matter and formation of humic substances, which improve long-term soil health. By recycling nutrients back into the soil, vermicomposting supports a circular nutrient economy, ensuring efficient resource utilization and reduced dependence on synthetic fertilizers. Collectively, these benefits position vermicomposting as an important component of climate-smart agriculture, integrating waste management, soil restoration, and sustainable crop production strategies.

9 Challenges and Future Perspectives

Despite its numerous benefits, vermicomposting faces several practical and technological challenges that limit its large-scale adoption. Mechanization at commercial levels remains constrained due to the biological sensitivity of earthworms and the need for controlled environmental conditions. Earthworms are highly susceptible to extreme temperatures, excessive moisture fluctuations, and direct sunlight, making climate management a critical factor in successful production systems. Furthermore, the lack of standardized quality parameters for vermicompost creates variability in nutrient content, maturity indices, and microbial composition, which affects market confidence and regulatory acceptance. Integration of vermicomposting into precision farming systems also requires improved monitoring tools and data-driven nutrient management strategies. Future research should therefore focus on enhancing beneficial microbial consortia to improve nutrient efficiency, developing biofortified vermicompost enriched with specific micronutrients or plant growth-promoting organisms, and formulating liquid vermicompost extracts for fertigation and foliar applications. Additionally, designing commercially viable scalability models with mechanized handling, quality control protocols, and cost-effective production systems will be essential for expanding vermicomposting as a mainstream sustainable agricultural technology.

10 Conclusion

Vermicomposting of sheep, cow, and poultry manures provides an efficient biological strategy for sustainable waste recycling and soil fertility enhancement. Although nutrient composition varies among manure types, vermicomposting stabilizes organic matter, improves nutrient availability, reduces pathogens, and enhances agronomic performance. Adoption of manure-based vermicomposting supports environmentally responsible agriculture, soil health restoration, and long-term productivity.

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