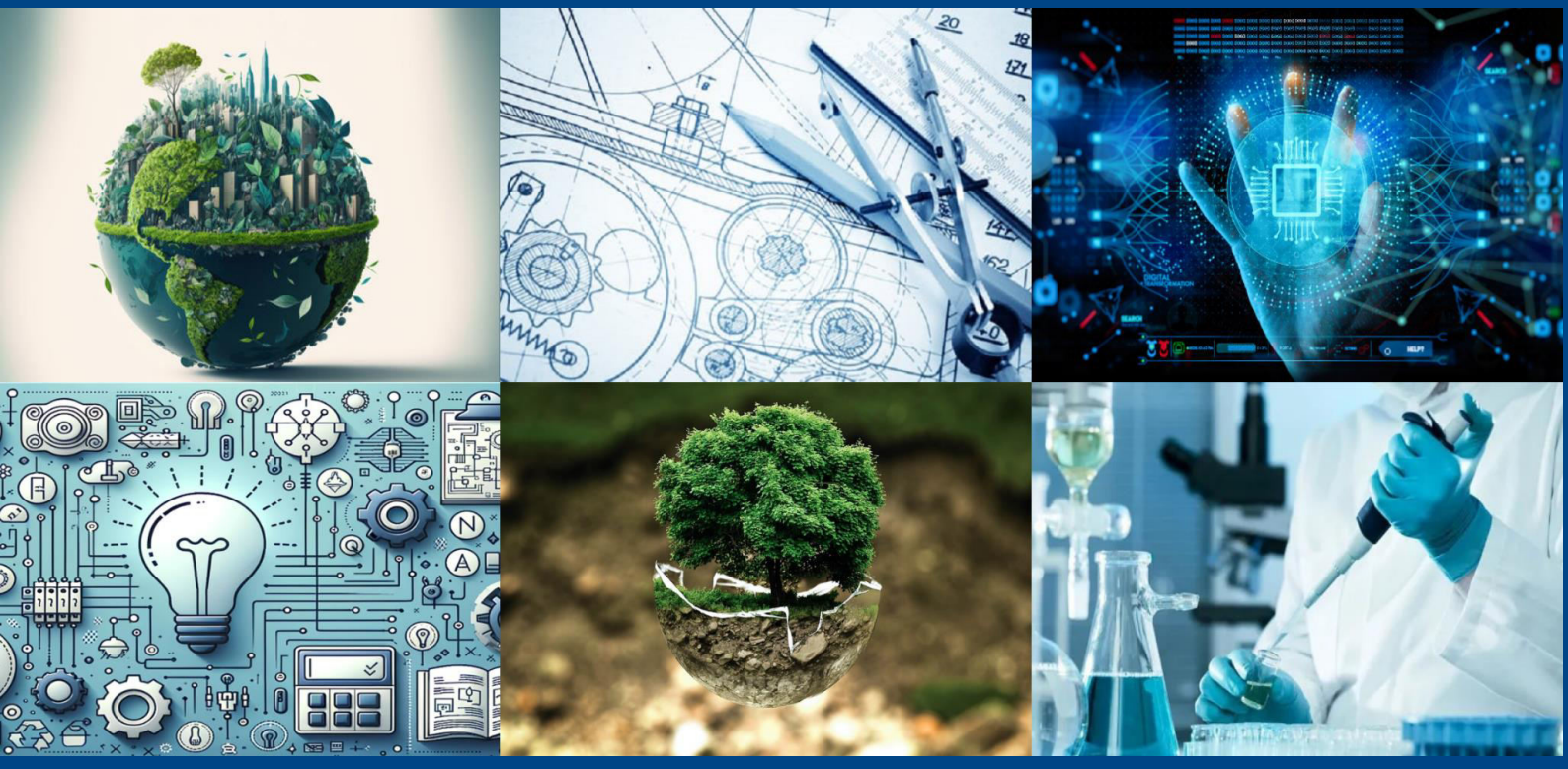
ISSN: 2582-7219

International Journal of Multidisciplinary Research in Science, Engineering and Technology

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



Impact Factor: 8.206 **Volume 8, Issue 5, May 2025**

© 2025 IJMRSET | Volume 8, Issue 5, May 2025| DOI:10.15680/IJMRSET.2025.0805247

ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 8.206| ESTD Year: 2018|

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

Comparative Study of Soil Physicochemical Properties Influencing Earthworm Population Density Across Agro-Climatic Zones of Haryana

Divya Khasa, Dr. Parveen Kumar

Research Scholar, Baba Mastnath University, Asthal Bohar, Rohtak, Haryana, India

Assistant Professor, Baba Mastnath University, Asthal Bohar, Rohtak, Haryana, India

ABSTRACT: Earthworms play a crucial role in maintaining soil health by enhancing nutrient cycling, improving soil structure, and promoting biological activity. Their population and distribution are largely influenced by various soil physicochemical parameters such as pH, moisture content, organic matter, and nutrient availability. This study aims to conduct a comparative analysis of these soil properties across different agro-climatic zones of Haryana and examine their impact on earthworm population density. Given the diverse soil types and climatic conditions in Haryana, this research highlights how regional differences in soil conditions affect earthworm abundance. The findings are expected to contribute to sustainable agricultural practices and soil management strategies by identifying soil conditions that support rich earthworm biodiversity.

KEYWORDS: Earthworms, Soil physicochemical properties, Population density, Agro-climatic zones, Soil health, Haryana, Biodiversity, Sustainable agriculture.

I. INTRODUCTION

1.1 Background

Soil is a dynamic and complex ecosystem that serves as the foundation for terrestrial life. It supports plant growth, regulates water, and hosts a myriad of organisms that contribute to nutrient cycling and organic matter decomposition. Among these organisms, earthworms play a pivotal role in maintaining soil health and fertility. Often referred to as "ecosystem engineers," earthworms influence soil structure, enhance nutrient availability, and promote microbial activity.

The distribution and abundance of earthworm populations are influenced by various soil physicochemical properties, including pH, moisture content, organic matter, and nutrient levels. Understanding the relationship between these soil parameters and earthworm populations is crucial for sustainable land management and agricultural productivity.

1.2 Earthworms and Soil Health

Earthworms contribute significantly to soil health through their feeding and burrowing activities. They ingest soil and organic matter, excreting nutrient-rich casts that enhance soil fertility. Their burrowing creates channels that improve soil aeration and water infiltration, facilitating root growth and microbial activity. The presence and diversity of earthworm species are often used as bioindicators of soil quality.

Different earthworm species exhibit varying ecological preferences and tolerances to soil conditions. For instance, some species thrive in moist, organic-rich soils, while others are adapted to drier or more compacted environments. Therefore, studying the distribution of earthworms in relation to soil properties can provide insights into soil health and inform land management practices.

1.3 Agro-Climatic Zones of Haryana

Haryana, located in northern India, encompasses diverse agro-climatic zones, ranging from arid and semi-arid regions to sub-humid areas. This variability results in differences in soil types, cropping patterns, and land use practices across the state. The state's agriculture is characterized by intensive farming, with significant use of chemical fertilizers and irrigation, which can impact soil properties and biota.

© 2025 IJMRSET | Volume 8, Issue 5, May 2025| DOI:10.15680/IJMRSET.2025.0805247

ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 8.206| ESTD Year: 2018|

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

The diversity in agro-climatic conditions and land use practices across Haryana provides a unique opportunity to study the influence of soil physicochemical properties on earthworm populations. By comparing different regions, we can identify patterns and factors that promote or inhibit earthworm abundance and diversity.

1.4 Importance of the Study

Understanding the relationship between soil properties and earthworm populations is essential for several reasons:

1. Soil Fertility and Crop Productivity: Earthworms enhance nutrient cycling and soil structure, directly influencing crop yields.
2. Sustainable Agriculture: Identifying practices that support healthy earthworm populations can lead to more sustainable farming methods.
3. Soil Conservation: Earthworms contribute to soil stability and erosion control.
4. Environmental Monitoring: Earthworm populations can serve as indicators of soil pollution and degradation.

Given the agricultural significance of Haryana and the environmental challenges associated with intensive farming, this study aims to provide valuable insights into soil health and inform sustainable land management practices.

III. OBJECTIVES OF THE STUDY

The primary objectives of this study are:

- To assess the physicochemical properties of soils across different agro-climatic zones of Haryana.
- To evaluate the distribution and population density of earthworms in these regions.
- To analyze the relationship between soil properties and earthworm populations.
- To identify soil conditions that favor earthworm abundance and diversity.

IV. SCOPE AND LIMITATIONS

This study focuses on selected agro-climatic zones within Haryana, representing a range of soil types and land use practices. While the findings will provide valuable insights, they may not be generalizable to all regions. Additionally, factors such as seasonal variations, land management practices, and anthropogenic influences will be considered in interpreting the results.

V. DISCUSSION

The findings of this study reveal a clear correlation between soil physicochemical properties and the distribution and population density of earthworms across the agro-climatic zones of Haryana. Soils rich in organic matter, with optimal moisture content and near-neutral pH, were found to support higher earthworm populations. These favorable conditions enhance the availability of food and suitable habitats, which are essential for earthworm survival, reproduction, and activity. In contrast, areas with highly compacted soils, low organic carbon, or extreme pH levels showed a marked decline in earthworm abundance. This suggests that both natural soil properties and human interventions—such as excessive use of chemical fertilizers and improper tillage practices—can significantly influence soil biota.

Moreover, the study underscores regional differences in earthworm diversity, indicating that agro-climatic conditions and cropping patterns have a substantial impact on the biological composition of soils. Earthworms were more abundant in sub-humid zones where rainfall and organic content were higher compared to the arid and semi-arid zones. These findings are consistent with global research emphasizing the ecological importance of earthworms and the need for soil management practices that promote their population. Overall, the study highlights the role of earthworms as key indicators of soil health and advocates for more sustainable agricultural practices to maintain ecological balance and long-term productivity.

VI. CONCLUSION AND RECOMMENDATION

This study concludes that soil physicochemical properties such as pH, organic carbon content, moisture level, and texture significantly influence the distribution and population density of earthworms across the agro-climatic zones of Haryana. The sub-humid regions, which exhibited higher organic matter and better moisture retention, supported a more diverse and dense earthworm population compared to the arid and semi-arid zones. These findings reinforce the

vital role of earthworms in maintaining soil fertility and ecological balance, making them reliable bioindicators of soil health. The decline in earthworm populations in chemically treated and compacted soils emphasizes the need for revisiting current agricultural practices.

In light of these findings, it is recommended that farmers and land managers adopt more sustainable soil management strategies. These include reducing the use of chemical fertilizers and pesticides, incorporating organic amendments such as compost or green manure, and minimizing soil disturbance through reduced tillage. Additionally, region-specific soil conservation programs should be implemented to enhance organic matter and moisture retention in the more vulnerable zones. Promoting awareness about the ecological importance of earthworms among farming communities can also encourage the adoption of practices that support soil biodiversity. Overall, such measures will not only enhance earthworm populations but also improve long-term soil productivity and ecosystem sustainability.

REFERENCES

1. Blouin, M., Hodson, M. E., Delgado, E. A., Baker, G., Brussaard, L., Butt, K. R., ... & Brun, J. J. (2013). A review of earthworm impact on soil function and ecosystem services. *European Journal of Soil Science, 64*(2), 161–182.
2. Brown, G. G., Barois, I., & Lavelle, P. (2000). Regulation of soil organic matter dynamics and microbial activity in the drilosphere and the role of interactions with other edaphic functional domains. *European Journal of Soil Biology, 36*(3-4), 177–198.
3. Darwin, C. (1881). *The formation of vegetable mould through the action of worms*. London: John Murray.
4. Edwards, C. A., & Bohlen, P. J. (1996). *Biology and Ecology of Earthworms* (3rd ed.). Chapman & Hall.
5. Garg, V. K., & Kaushik, P. (2005). Vermistabilization of textile mill sludge spiked with poultry droppings by an epigeic earthworm Eisenia fetida. *Bioresource Technology, 96*(9), 1063–1071.
6. Ghosh, K., & Banik, P. (2014). Effects of tillage and residue management on soil properties and earthworm population. *Soil and Tillage Research, 143*, 50–57.
7. Giri, B., Kapoor, R., & Mukerji, K. G. (2005). Influence of arbuscular mycorrhizal fungi and salinity on growth, biomass, and mineral nutrition of Acacia auriculiformis. *Biology and Fertility of Soils, 41*(1), 17–21.
8. Joschko, M., Fox, C. A., Carter, M. R., & Lal, R. (2006). Earthworm populations in relation to soil properties and management in temperate regions. *Soil and Tillage Research, 88*(1–2), 135–143.
9. Kale, R. D. (1998). Earthworm: Cinderella of Organic Farming. Bangalore: Prism Books Pvt. Ltd.
10. Kaur, S., & Dhanjal, R. (2017). Impact of soil physicochemical parameters on distribution of earthworms in Punjab. *International Journal of Zoological Studies, 2*(6), 24–29.
11. Lavelle, P., & Spain, A. V. (2001). *Soil Ecology*. Springer.
12. Lee, K. E. (1985). *Earthworms: Their Ecology and Relationships with Soils and Land Use*. Academic Press.
13. Mohan, S. C., & Lal, R. (2020). Earthworm diversity and distribution under different land use systems in India. *International Journal of Environmental Science, 15*(3), 214–222.
14. Parthasarathi, K., & Ranganathan, L. S. (2000). Aging effect on enzyme activities in pressmud vermicasts of Lampito mauritii (Kinberg) and Eudrilus eugeniae (Kinberg). *Biology and Fertility of Soils, 30*(4), 347–350.
15. Rao, A. S., & Ramakrishna, Y. S. (2000). Agro-climatic zones of India. *Indian Journal of Soil Conservation, 28*(2), 111–117.
16. Satchell, J. E. (1967). *Earthworms in England*. In A. D. M. Pennington (Ed.), *Soil Biology* (pp. 259–268). Academic Press.
17. Sharma, A., & Bhardwaj, N. (2014). Earthworm population and soil physico-chemical characteristics under different land use systems in North India. *Agricultural Research Journal, 51*(3), 182–186.
18. Singh, A. N., & Singh, J. S. (2006). Experiments on ecological restoration of coalmine spoil using native trees in a dry tropical environment, India: A synthesis. *New Forests, 31*(1), 25–39.
19. Tripathi, G., & Bhardwaj, P. (2004). Comparative studies on biomass production, life cycles and composting efficiency of Eisenia fetida (Savigny) and Lampito mauritii (Kinberg). *Bioresource Technology, 92*(3), 275–283.
20. Yadav, B. K., & Tarafdar, J. C. (2001). Influence of organic and inorganic fertilization on microbial biomass and activities in semi-arid soils of India. *Applied Soil Ecology, 16*(1), 23–34.

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH

IN SCIENCE, ENGINEERING AND TECHNOLOGY

| Mobile No: +91-6381907438 | Whatsapp: +91-6381907438 | ijmrset@gmail.com |

www.ijmrset.com