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Earthworms & Its Importance in Soil Fertility

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"Earthworms are indicators of soil fertility. The population size of the earthworm indicates the quality of the soil, as healthy soil would contain a larger number of earthworms."

INTRODUCTION

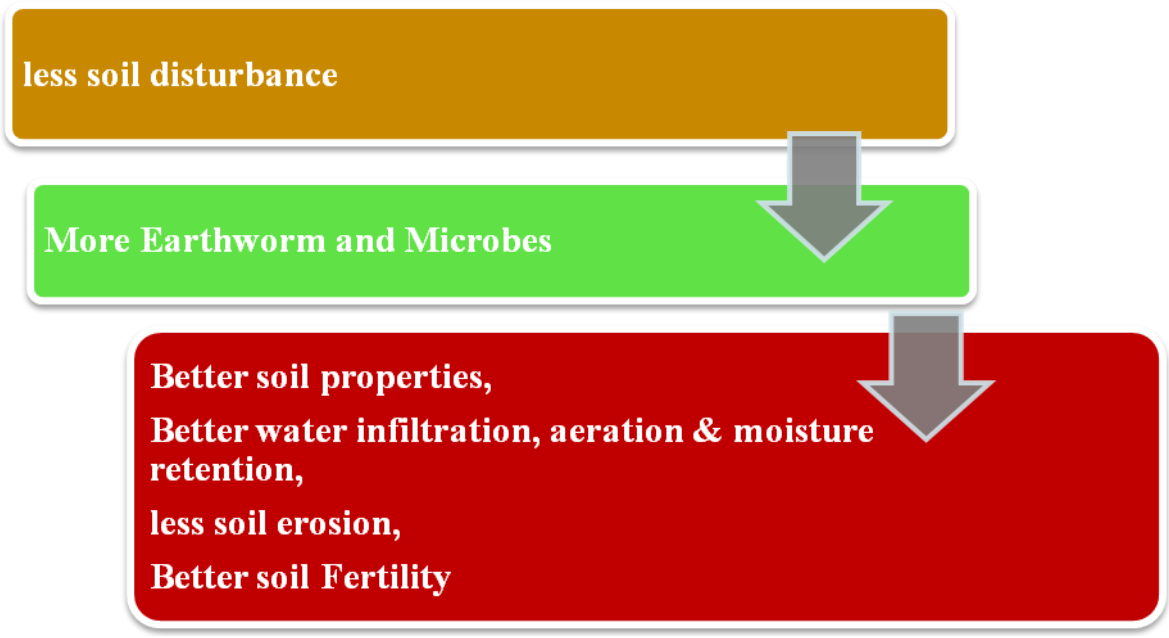
As the world's population continues to grow and agricultural land is decreasing day by day, food shortages are becoming a serious issue. In order to produce more food from less agricultural land in the coming years, we will need to rely on sustainable development, and earthworms can play a valuable part in this. There are about 1800 species of earthworm widely dispersed all over the world (**Edwards and Bohlen, 1996**) and constitute 80% of the total soil invertebrate's biomass (**Nainawate and Nagendra, 2001**). In recent study, 3627 species are known worldwide (**Kooch and Jalilvand, 2008**). India is one of the important mega biodiversity countries and only 11.1% of earthworm diversity is available out of total global earthworm's diversity (**Chaudhuri and Nath, 2011**).

In addition to bringing nutrients from the deeper soil layers that plants can easily absorb, earthworms also play a crucial role in the dynamics of soil organic matter. They were also reported to increase the addition of macroaggregates from the cover crop as well as microaggregates consisting of macroaggregates. As a result of the increased organic C and N transfer into soil aggregates, earthworms may be able to help agricultural systems stabilise and accumulate soil organic matter (**Brady and Weil, 1996**). Furthermore, earthworms improve nitrogen mineralisation by influencing the microbial population both directly and indirectly. Earthworms ingest soil, passing it through their digestive system. This process helps to distribute nutrients more evenly throughout the soil, making them more accessible to plants.

They also help in soil aeration, good root penetration, improved drainage, and water retention, creating a favourable environment for beneficial microorganisms to thrive and further improving the soil fertility and crop productivity.

Indicators of insufficient or absent earthworm populations include low or no organic residues in the soil, high soil temperatures, and low soil moisture, all of which are detrimental to both earthworms and sustainable crop development (**Singh *et al.*, 2016)**. Earthworms promote the breakdown of organic materials. The cycling and availability of nutrients for plant uptake may be diminished in the absence of earthworms. It is also possible to decrease aggregate stability and natural drainage. It could be necessary to perform soil restoration in order to improve aeration and drainage, break up compacted layers to improve nutrient cycling, and stabilise the soil to prevent erosion. Some soils have inherent characteristics that make them productive even without earthworms. There are 3 main group of earthworms, classified based on habitats:

1. **Litter dwellers:** These earthworms live in plant litter and feed on plant residues. They are absent in ploughed soil where plant litter is absent or in negligible amounts.
2. **Mineral soil dwellers:** These earthworms are found in organic matter-rich topsoil. These worms create burrows as they feed on a mix of soil and plant residues.
3. **Deep soil burrowers**: these earthworms dig large and deep channels into lower soil layers, carrying plant residue with them as they feed.



EARTHWORMS CONTRIBUTE IN SOIL FERTILITY

- ✓ Improve soil stability, air porosity, and moisture holding capacity by burrowing and aggregating soil.
- ✓ Improve root growth by creating channels lined with nutrients for plant roots to follow.
- ✓ Increase porosity and thus reduce compaction of soil.
- ✓ Earthworms promote the colonization and propagation of beneficial soil bacteria and fungi in their burrows and casts.
- ✓ Produce casts rich in N, P, K, and other nutrients. The worm casts form stable soil aggregates or crumbs, which are deposited on the soil surface or in the soil. Organic and inorganic fractions are well-mixed in worm casts, and the nutrients are present in a readily available and enriched form.
- ✓ Earthworms incorporate organic material such as crop residues, organic manure, dung or mulch into the soil. They fragment, mix and digest plant debris through physical grinding and chemical digestion. This accelerates the decomposition of the dead plant matter and thus stimulates the nutrient cycling in the soil-plant system.
- ✓ Earthworms transport soil material

and nutrients from the subsoil to the topsoil and thus maintain respectively foster the vitality of the soil.

- ✓ Improve water infiltration by forming channels and reduce surface runoff.
- ✓ Reduce the incidence of disease by bringing deeper soil to the surface and burying organic matter.
- ✓ Earthworm burrows increase the amount of macropores and thus contribute to a good aeration of the soil.
- ✓ By the intensive mixing of organic matter with inorganic soil particles and microorganisms and by slime secretion, earthworms create stable soil crumbs, which enhance soil structure. Soils with high earthworm activity have less tendency to become muddy and can be worked more easily than soils with low earthworm activity. In addition, nutrients and water are more effectively retained in the soil.
- ✓ Earthworms distribute insect-killing nematodes and fungi in the soil, thus contributing to a better natural regulation of soil-borne pests.
- ✓ Earthworms ingest organic residues of different C: N ratios and convert it to a lower C: N ratio and finally contribute to carbon sequestration. By doing so, they help mitigate climate change.

CONCLUSION

Earthworm, as an indicator of soil fertility, indicates the quality of soil, as healthy soil would contain a larger number of earthworms. They are an important part of the soil ecosystem. Their presence is a good indicator of soil conditions suitable for plant growth. They not only improve soil physical properties but also soil chemical and biological properties. Earthworms digest organic matter and convert it into humus. Humus has a high value of inorganic salts like N, P, K, and Ca; these are the main integrants that enhance crop productivity. However, the environment and agroecosystem are being destroyed by the extensive use of chemical fertilisers brought on by modern technologies and human greed for greater yields. Consequently, earthworm

populations are declining, which lowers soil fertility. For healthy and productive soil, an integrated approach should be followed so that the earthworm population is enhanced, like No Till. Crop rotations with legumes, cover crops, manure, fertiliser, and lime applications all affect earthworm populations.

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