Earthworm

An earthworm is a tube-shaped, segmented worm found in the phylum Annelida. They are commonly found living in soil, feeding on live and dead organic matter. An earthworm's digestive system runs through the length of its body. It conducts respiration through its skin.

Earthworms are hermaphrodites: each individual carries both male and female sex organs.

Earthworms are far less abundant in disturbed environments and are typically active only if water is present.

Earthworms do not have eyes , however, they do have specialised photosensitive cells called "light cells of Hess". These photoreceptor cells have a central intracellular cavity (phaosome) filled with microvilli. As well as the microvilli, there are several sensory cilia in the phaosome which are structurally independent of the microvilli. The photoreceptors are distributed in most parts of the epidermis but are more concentrated on the back and sides of the worm.

Earthworms travel underground by the means of waves of muscular contractions which alternately shorten and lengthen the body (peristalsis). The shortened part is anchored to the surrounding soil by tiny claw-like bristles (setae) set along its segmented length. In all the body segments except the first, last and clitellum.

The major benefits of earthworm activities to soil fertility for agriculture can be summarized as:

Biological: In many soils, earthworms play a major role in the conversion of large pieces of organic matter into rich humus, thus improving soil fertility. This is achieved by the worm's actions of pulling below the surface deposited organic matter such as leaf fall or manure, either for food or to plug its burrow. Once in the burrow, the worm will shred the leaf and partially digest it and mingle it with the earth.

Chemical: In addition to dead organic matter, the earthworm also ingests any other soil particles that are small enough—including sand grains up to 1/20 of an inch (1.25 mm)—into its gizzard, wherein those minute fragments of grit grind everything into a fine paste which is then digested in the intestine. When the worm excretes this in the form of casts, deposited on the surface or deeper in the

soil, minerals and plant nutrients are changed to an accessible form for plants to use.

Physical: The earthworm's burrowing creates a multitude of channels through the soil and is of great value in maintaining the soil structure, enabling processes of aeration and drainage.

earthworms "act as an innumerable army of pistons pumping air in and out of the soils on a 24-hour cycle ". Thus, the earthworm not only creates passages for air and water to traverse the soil, but also modifies the vital organic component that makes a soil healthy

. Earthworms promote the formation of nutrient-rich casts (globules of soil, stable in soil . that have high soil aggregation and soil fertility and quality.

The ability to break down organic materials and excrete concentrated nutrients makes the earthworm a functional contributor in restoration projects. In response to ecosystem disturbances,

Benefits of earthworms

By their activity in the soil, earthworms offer many benefits: increased nutrient availability, better drainage, and a more stable soil structure, all of which help improve farm productivity.

Improved nutrient availability

Worms feed on plant debris (dead roots, leaves, grasses, manure) and soil. Their digestive system concentrates the organic and mineral constituents in the food they eat, so their casts are richer in available nutrients than the soil around them. Nitrogen in the casts is readily available to plants. Worm bodies decompose rapidly, further contributing to the nitrogen content of soil.

Improved drainage

The extensive channelling and burrowing by earthworms loosens and aerates the soil and improves soil drainage. Soils with earthworms drain up to 10 times faster than soils without earthworms. In zero-till soils, where worm populations are high, water infiltration can be up to 6 times greater than in cultivated soils. Earthworm tunnels also act, under the influence of rain, irrigation and gravity, as passageways for lime and other material.

Improved soil structure

Earthworm casts cement soil particles together in water-stable aggregates. These are able to store moisture without dispersing. Research has shown that earthworms which leave their casts on the soil surface rebuild topsoil. In favourable conditions they can bring up about 50 t/ha annually, enough to form a layer 5 mm deep. One trial found worms built an 18-cm thick topsoil in 30 years.

Improved productivity

Research into earthworms in New Zealand and Tasmania found earthworms introduced to worm-free perennial pastures produced an initial increase of 70–80% in pasture growth, with a long-term 25% increase: this raised stock carrying capacity. Researchers also found that the most productive pastures in the worm trials had up to 7 million worms per hectare, weighing 2.4 tonnes. There was a close correlation between pasture productivity and total worm weight, with some 170 kg of worms for every tonne of annual dry matter production.

How to encourage earthworms

Because earthworms do not like soil that is too acid, alkaline, dry, wet, hot or cold, their presence is a good indicator of soil conditions suitable for plant growth.

Ensure soil pH (CaCl2) is above 4.5

Earthworms do not like acid soils with pH (CaCl2))* less than 4.5. The addition of lime raises pH and also adds calcium. Earthworms need a continuous supply of calcium, so are absent in soils low in this element. South Australian research found that earthworm numbers doubled when pH(CaCl2) rose from 4.1 to 6.7.

pH can be measured in water or calcium chloride (CaCl2). The CaC12 method is more accurate and gives values of about 0.5–0.8 lower than water pH. A pH(CaCl2) of 4.5 measures about 5.0–5.3 in water.

Increase organic matter

Earthworms feed on soil and dead or decaying plant remains, including straw, leaf litter and dead roots. They are the principal agents in mixing dead surface litter with the soil, making the litter more accessible to decomposition by soil microorganisms. Animal dung is also an attractive food for many species of earthworms. The following farming practices provide food for earthworms.

Permanent pasture: Permanent pasture provides organic matter as leaves and roots die and decay. Pasture slashings and manure from grazing animals are also good sources of organic matter in pasture.

Green manure crops: Green manure crops are fodder crops turned into the soil to provide organic matter to benefit the following crop. The crops are grazed or slashed, sometimes pulverised, and then left on the surface or turned into the soil.

Crop stubble: Stubble is an important source of organic matter. Burning stubble destroys surface organic matter, and this affects worm numbers. It is best to leave stubble to rot down, and sow following crops into the stubble using aerial sowing, direct drill or (at least) minimum tillage. All these techniques mean less cultivation, and this also encourages earthworms.