

Earthworms and soil health

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08456 000 813

Under ideal conditions, a healthy earthworm population can process around 12 tonnes of soil and organic matter in a year, and a healthy pasture will have a greater weight of stock beneath the surface than above. Research figures from Rothamsted Research Station suggest that even poor soil may support 600,000 earthworms/hectare (62/m²), whilst rich fertile grassland may have up to 4,300,000 earthworms/hectare (432/m²).

Benefits to soil health

Earthworms **improve soil structure** by dragging down organic matter, **mixing soil** and creating tunnels that **improve drainage**. **Worm casts** are rich in recycled plant nutrients, and can contain up to 40% more beneficial humus than the top 23cm of soil. Research has shown that a fresh worm cast can hold as much as five times more accessible **nitrogen**, seven times more accessible **phosphorous** and 11 times more accessible **potash** than the surrounding top soils. It's estimated that there are **around 3,000 different species** of earthworms found globally, with about **27 species in the UK**.

Here are the three more common types:

Organic matter dwelling (Epigeic)

- Live at or near the soil surface
- Tend not to burrow into the soil
- Eat material that is high in organic matter, e.g. decaying plant roots and shoots, dung and leaves
- Reproduce rapidly
- Short-lived
- Often bright red with no stripes



A sub-group of these are **compost worms** which prefer warm and moist environments with a ready supply of fresh compost material. They very rapidly consume this material and reproduce very quickly. Compost earthworms tend to be bright red and stripy and larger than most other mature earthworms

Topsoil dwelling species (Endogeic)

- Live in the top 20-30cm of soil
- Eat significant volumes of soil and decaying organic matter
- Burrow through the soil, ingesting as they go, creating branching horizontal burrows and mixing the top soil layer - will reuse burrows to a certain extent
- Not important in the incorporation of surface litter
- Produce stable casts
- Reproduce rapidly - approx. 1.4 young per adult per week in some species!
- Have no skin pigmentation - usually pale grey or yellow



Subsoil dwelling species (Anecic)

- Deep burrowers ('nightcrawlers')
- Create large, vertical, permanent burrows up to two metres deep in the soil profile
- Come up to the surface to feed, pulling surface plant residues and living plant material down into the mouth of the burrow to soften and be eaten
- Responsible for much of the worm casts usually found on the surface in grassland - usually deposited around the entrance to their burrows
- Populations are heavily influenced by tillage and rotations that reduce surface residue levels. To avoid being scooped up by predators, the species *L. terrestris* has developed retractable bristles called setae, which grip the burrow wall
- Darkly coloured at the head end and paler towards the tail



Best conditions for good earthworm numbers

Soil temperature - most earthworm species are happy at a range of temperatures but require a minimum of around 7°C. Below this, the adult population drops, although eggs remain viable.

Good organic matter content - without organic matter, the worm population is unable to sustain itself. Soils with low organic matter have depleted earthworm numbers.

Soil pH - an acidic soil severely impacts on earthworm numbers - although some species in the UK have been found at pH4.3, the optimum is above pH6.

Soil compaction - to a point, compaction in soils can stimulate casting activity in worm populations, but heavily compacted soils limit the earthworm's ability to burrow, compounding compaction issues. In a well aerated soil, the earthworm's movement acts as a piston, forcing air deeper into the soil, increasing drainage, and nutrient uptake. Their burrows are also very important for letting water into and through soil. This influx of water can flush air out of the soil to be replaced by 'fresh' air.

Why are earthworms so important?

These organic matter dwelling, topsoil and subsoil dwelling earthworms give the farmer a range of benefits because they work throughout the soil from the surface to deep down in the soil profile.

Their activity results in:

- Improved nutrient availability - the casts they produce are rich in nutrients and when their bodies decompose, more nutrients are released to the soil
- Improved drainage - their burrows allow movement of air and water through the soil; this is most noticeable in no till systems where movement of water through the soil can be much greater than in cultivated soil
- Improved soil structure – through improving the topsoil by creating stable soil aggregates able to store moisture
- Improved productivity – as a result of all of the above

More information

The Earthworm Society of Britain www.earthwormsoc.org.uk

YouTube video: [The Amazing World of Earthworms in the UK](#)



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www.gov.wales/farmingconnect

