Deep ploughing reduces diversity and number of earthworms

Less invasive soil preparation methods in farming, such as harrowing, have a positive impact on the numbers, biomass, and species richness of earthworms, unlike conventional ploughing, according to new research. The long-term study compared the results of five different methods of soil preparation on agricultural land in Germany over a ten-year period.

Earthworms play a major role in the functioning of soil ecosystems. They help keep soil healthy by enhancing the turnover of organic residues, increasing microbial activity, and contributing to enhanced mineral take-up and nutrient availability in the soil. Their burrowing and feeding activities alter the soil structure and its ability to absorb water. These benefits improve crop productivity.

The five soil preparation methods compared in the study were:

- conventional ploughing to a depth of 25 cm
- non-invasive loosening of soil to 15 cm, using a wide-bladed grubber (a tilling tool)
- slight loosening of soil to 15 cm with a disc harrow (also a tilling tool)
- sowing seeds with a shallow grubber, which leaves a layer of mulch on the soil surface
- direct sowing without any soil tillage

After ten years, the numbers, size and community composition of earthworms were measured. They varied strongly depending on the type of soil tillage used. For example, the number of earthworms per square metre varied between 119 in ploughed land and 160 in land treated with the disc harrow.

Other key results include:

- Overall, total bulk size of earthworms was significantly higher with disc harrow treatment relative to ploughed land
- All less-invasive tillage treatments resulted in higher species richness – eight species were found in these soils, compared with six species in ploughed soils
- The density of larger (anecic) earthworms decreased in deep ploughed soils, probably a result of mechanical damage to their bodies and disturbance of their habitats
- The density of smaller (endogeic) earthworms increased in deep ploughed soils, probably a result of the lower bulk density of the soil and transport of organic matter to lower levels

The researchers believe that loss of earthworm biodiversity has a negative effect on soil functioning in agricultural ecosystems, especially in areas of intensive farming. They conclude that changing from conventional ploughing to reduced or conservation tillage methods changes the distribution of soil organic content in topsoil and has a positive effect on earthworm populations. These could be important ways of sustaining soil conservation and plant production in agro-ecosystems. However, potential negative affects of reduced tillage, such as possible increased herbicide use, were not discussed in this study and would need to be considered before implementing these practices.


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