

## EXECUTIVE SUMMARY

The project aimed to characterise earthworm population dynamics and behaviour under rotational cropping, comparing organic and conventional systems. Benefits arising from earthworm activity in terms of soil fertility were also assessed. Although some difficulties were encountered with details of the work, these problems did not affect the overall reliability of research findings and the broad aims were achieved.

Earthworm populations, casting and burrowing, and selected soil or cast properties (microbial biomass, available P and K, organic content and aggregate stability) were monitored on three pairs of matched organic-conventional farms over a two year period. Farm pairs represented a gradation from stockless to ley-arable systems. The survey was extended in the final year to include a further four farm pairs sampled on a single occasion.

Population data indicated the marked beneficial effect of leys within rotations and their key role in maintaining high earthworm densities in organic systems. Although there were some indications of species differences between systems, patterns of variation were essentially similar for the biomass and abundance of the total population and of individual species. Tillage did not appear to have a large or persistent effect on earthworms. Populations increased under leys, approaching the size and species composition of permanent pasture after 3-4 years. There were, however, examples where low populations of earthworms failed to respond to favourable ley management. Much of the beneficial effect of leys was dissipated after one year of cereal cropping.

There was some evidence of increased surface burrowing in organic compared with conventional systems, a feature explained partly by higher densities of the more shallow dwelling species and partly by higher levels of activity for a given population density. Efforts to relate burrowing activity to water infiltration were only partially successful, the technique used being ineffective on cereals or recent leys. Earthworm casts had higher organic and nutrient contents, microbial biomass and aggregate stability than underlying soil. These differences tended, if anything, to be greater in conventional compared with organic systems.

A high proportion of the variation in earthworm populations could be accounted for by soil and agronomic factors within individual sites. However, the importance and direction of individual factors varied between sites.

Given the benefits arising from large and active populations, for soil fertility and within the larger agricultural ecosystem, there are sound reasons for encouraging systems of farming which favour earthworms. Organic farming is one such system, although including or increasing the proportion of leys in rotations may achieve many of the benefits associated with organic husbandry. Within organic rotations, the key role of leys, their management and break up, is clear.

The need for further work is indicated in several areas including:

- minimum populations require to deliver soil/environmental benefits and to ensure sustainable use of soil resources;
- system differences in earthworm impacts on nutrient cycling;
- agronomic options within organic farming as they affect populations;
- interactions with other soil organisms