

Active soils function better

A little organic matter goes a long way in a short space of time, it seems. *Sarah Henly* asks researcher *Andy Whitmore* how growers should choose and use it to enhance crop yields

■ Worms have never been as interesting to soil biologists as they are now. Their behaviour could explain why applications of farmyard manure (FYM) are so valuable to crop yield.

Previous trials at Rothamsted Research have shown the addition of FYM can improve yields of barley grain and straw by more than 1t/ha each. And contrary to popular belief, these striking benefits can be achieved relatively rapidly, says Andy Whitmore of Rothamsted Research.

“We were shocked to learn a few years ago that what we thought would take decades could be achieved in two seasons using good-quality manure to improve yields from organic matter content of soil. We are now asking what organic matter is doing to soil beyond boosting its nutrients. We think it acts as an energy source for soil organisms whose activities deliver benefits in terms of soil aeration and water and nutrient uptake,” he says.

HGCA perspective by *Shamal Mohammed*

Research and knowledge transfer manager, HGCA



■ “Soil health is intimately linked to soil biology and experimental work shows a clear relationship between earthworm activity and crop yields. But soil organisms such as earthworms need a good supply of organic matter in order to thrive. Our research is looking at the best way to ‘feed’ the soil by testing a range of organic materials applied at different rates, times and frequencies, to improve soil health and crop yields in a relatively short period of time.”



TIM SCRIVENER

Deep-burrowing earthworms can help reduce root resistance.

Deep-burrowing – anecic – earthworms have permanent burrows, and reduce root resistance while increasing water availability at depth. The common lobworm is anecic. Shallow burrowers – endogeic types – don't have permanent burrows and they ingest the soil as they move through the surface layer, creating smaller pores. Understanding more about their behaviour will elucidate things, hopes Prof Whitmore.

During this four-year project, the team is growing various crops on 220 9x6m silty clay loam plots at Rothamsted, comparing a range of organic matter qualities, amounts and timings of delivery to soil. The growth and activity of earthworms will also be scrutinised in simpler pot experiments in different soils.

Types of organic matter include cattle manure, man-made compost, anaerobic digestate sourced from maize or food waste and crop residues. The straw incorporated varies with the rotation, either oilseed rape following spring barley or spring barley following wheat.

Prof Whitmore expects results to vary significantly. "The quality of the organic matter seems important because other long-term experiments on straw incorporation show little benefit following the addition of far more organic carbon. About 50% more earthworms were active in the FYM-enriched plots.

As well as earthworms, the team will measure the levels of beetles and spiders in pitfall traps, and the presence of soil microbes and fungi. Their influence on soil structure and other factors must be evaluated.

"We will survey earthworm populations in spring and continue to determine microbial biomass and community composition. Water infiltration and penetrometer resistance measurements will be linked, if possible, to yields."

By 2016, Prof Whitmore hopes to produce guidelines for using organic matter, including the economics of doing so, since transport costs differ from farm to farm. He will also assess both the environmental benefits and pollution such as nitrate leaching that derive from such applications.

Research reasons



This project aims to understand what organic matter does within the soil in order to establish best practice with a possibly low-cost resource that has been shown to improve crop yield

Project: Improvement of soil structure and crop yield by adding organic matter to soil

Timescale: September 2012-September 2016

Researchers involved: Rothamsted Research, Cranfield University, Agri-Food and Biosciences Institute Northern Ireland and Phil Wallace consultancy

Funders: HGCA, Produce World, Waitrose, Defra and Dard

Cost: £775,000 from HGCA of total £1.47m

Key points

- Using farmyard manure (FYM) can help soil support significantly higher cereal yields within just two seasons
- At least an extra 1t/ha each of grain and straw
- A minimum of five species of earthworms active in FYM-enriched soil

"It will be useful to know the minimum cost at which we can transport and spread the type of organic matter that has the maximum value to yield with minimum effect on the environment."