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Stimulation of soil biota through organic waste recycling for sustainable oil palm cultivation

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Sixteen million hectares of oil palm has been planted within the last few decades with dramatic changes in land-use. Despite this, soil biodiversity in plantations has been little investigated.

This study aims to assess the effect of organic waste recycling on soil biodiversity in a mature plantation in order to develop sustainable practices.

Observations were made in plantations located in Sumatra, Indonesia. Plots received 60 t.ha⁻¹ EFB (empty fruit bunches, an organic mill by-product) every two years, on the palm inter-row, parallel to the harvest path. Based on the standard spatial organisation and practices in plantations, four main zones were defined 1) EFB application band, 2) harvesting path, 3) weeded tree circle, and 4) windrow (regular biomass recycling – pruned leaves). We assessed soil macrofauna, nematofauna and bacteria, together with soil physical-chemical characteristics. Temporal variability was assessed based on a time-sequence with observations undertaken 1, 3, 6, 12, 18, and 24 months after EFB application.

Zones treated with EFB showed higher earthworm density and “maturity index” of nematodes communities. Bacterial diversity (number of genera) was higher under EFB, in the harvesting path and in the circle than in the windrow. Three successive periods were identified: a disturbance period (0-6 months), with reduced density of earthworms, diplopods and nematodes, but a higher density of ants; a resilience period (6-18 months); and a final period (24 months, i.e. just before new EFB application) characterized by the highest density of earthworms, dermapterans, diplopods, and nematodes.

Our results demonstrate spatial and temporal variation in biodiversity and density of soil organisms in oil palm plantations, and a significant impact of EFB application. This research is the first stage towards evaluating current practices and developing new strategies for maintaining and enhancing soil biodiversity and related services for sustainable oil palm cultivation.

Keywords: agricultural practices, sustainable agriculture, soil biodiversity conservation