
Plant-earthworm interaction : influence of age and proportion of casts in the soil on root morphology and nitrogen uptake by the plant

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Abstract

The prominent earthworm's effect on plant growth is due to their dejections, the so-called casts, a complex mixture of organic matter, minerals and microbes. In casts, the mineralization of soil organic matter increases the first days after cast release and then decreases. Furthermore, signal molecules such as auxin-like compounds, known to impact root cell elongation, have been found in fresh casts. These molecules could stimulate root growth towards the casts which acts as hot-spots of mineralization, thus inducing a more efficient nutrient uptake. We performed a pot experiment with different proportions (0, 25, 50 and 75% soil volume) of casts of increasing ages (1, 4, 10, 46 days) in presence of the plant *Brachypodium distachyon*. Casts were homogeneously labelled with ¹⁵N (ammonium & nitrate) in order to quantify the plant uptake of N from the casts. Plant biomass and morphology were analysed. Age of casts had a significant effect on root morphology, highlighting the importance of the kinetics of nutrient or signal molecule release. The proportion of casts had mainly a positive effect on aboveground biomass, indicating that root development modifications were increasing nutrient uptake efficiency of the plant. An interaction between age and proportion was observed on total biomass, shoot/root ratio and root ramifications, which suggested that the coupling between cast maturation and root development was essential to understand the effect of earthworms on plant growth. Ongoing ¹⁵N analyses should confirm our preliminary conclusions and provide a better appreciation of the N supply kinetics of earthworm casts.

Keywords: Biomass production, earthworm, nitrogen cycle, plant development, root morphology

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