
How does earthworm functional diversity affect rapeseed-weeds interactions?

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Abstract

A modification of paradigm arises from intensive agriculture in order to promote a sustainable agriculture based on biodiversity and ecological processes management. As earthworms contribute to soil fertility and structure, crops may be considered as agroecosystems relying on the functional roles of their organisms and their interaction networks. While many studies have shown a positive effect of earthworms on plant production, how earthworm functional diversity affects plant interactions is poorly understood. We aimed to test the particular role of earthworm functional diversity on plant competition between weeds and crops intercropped with a legume species. We assumed that earthworm functional diversity (i) promotes root growth and nutrient acquisition decreasing below-ground competition, but (ii) increases above-ground competition by indirectly promoting leaf growth of all species. To test these hypotheses, a mixture of rapeseed intercropped with a legume species and weeds was cultivated for 40 days in shallow rhizotrons filled with a non-fertilized soil under controlled conditions. Four levels of earthworm functional diversity were elaborated according to their localization in the soil profile, their cast production and cast enzymatic activities. To focus on functional diversity effects, plant density and earthworm biomass were kept constant amongst the various diversity treatments. Then, burrowing activity, root and leaf growths were followed every 2-3 days. At the end of experiment, plants were harvested and dry mass and nitrogen content were measured in shoots and roots. Results of root and burrow co-localization, as well as functional diversity effects on plant nutrient acquisition and biomass allocation will be presented.

Keywords: earthworm functional diversity, plant competition, root profile, nitrogen acquisition, root, burrow co, localization

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